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The Importance of Climatology to Tropical Agriculture

By FORMAN T. MCLEAN

Farmers of all lands are interested in the weather, as well as in the influence of soils, parasites, etc. on their crops. Generally, in the agricultural schools the greater part of the time is devoted to teaching the prospective farmers about soils and soil tillage, insect and disease control and plant breeding. Since these conditions are all more or less subject to the control of man, it is natural that the methods of dealing with them are emphasized. The weather is not amenable to man's authority as are the other important environmental factors of plants and animals, and for this reason is frequently slighted, and its most obvious effects are accepted as a matter of course.

This attitude toward weather conditions is unjustifiable, especially in the tropics. Here, on account of the dominating influence of the position of the sun, and its profound effect upon wind, cloudiness and precipitation, the weather is more dependable in its seasonal changes than it is generally in subtropical and temperate regions. The climate, or average weather of a locality is therefore a quite reliable guide to the weather to be anticipated at any particular season of each year. Therefore, a careful analysis and study of the climatic conditions as they affect plants and of the local variations in climate and their causes are eminently worth while.

Thus, in the Philippines the regular recurrence of the northeast trade wind from November to April and of the southwest monsoon from May to September are the controlling influences affecting sunshine and rainfall, through-

out the Islands. The local topography and proximity of large bodies of water and of high mountains determine the effects of these winds. A thorough understanding of these influences is therefore invaluable to any Philippine farmer.

The typhoons which occasionally visit the northern part of the Philippines add an erratic element to the climate, beside injuring certain crops, as Para rubber, to such an extent as to render them unprofitable in the sections where these storms occur. But even typhoons are found to be somewhat seasonal in their occurrence, and a study of their seasonal distribution will permit the farmer to so plan his operations as to reduce the loss from this cause to a minimum during a series of years.

There is one very important characteristic of both plants and animals in the tropics which adds to the importance of climatic studies here. All living things in the tropics where they are subjected to the constantly high temperatures are more sensitive to slight changes of temperature than they are in cooler regions. Consequently even the variations in temperatures between different localities which seem relatively slight have a disproportionately great significance. As an instance, the average temperature for the year, and for each month is lower at the College of Agriculture, Los Baños, than in Manila by about 1°C. This small difference in temperature makes the former place a much pleasanter locality for man to live in and a better place for several crops which thrive well in the cooler temperatures. Other seemingly insignificant variations in rain, cloudiness, humidity, or wind may cause equally important differences in thrift and productivity of tropical crops.

The intense insolation, resulting from the vertical position of the sun and the relatively thin blanket of air through which the light passes, makes the amount of cloudiness very important, for the heating and drying power of the sun is much greater in tropical than in temperate regions. Consequently many tropical plants regularly wilt during hot sunny days, and recover normal vigor only after sunset. Many plants from temperate climates require shade during the heat of the day in the tropics. The evil effects of intense tropical insolation has long been understood. Ewart showed nearly thirty years ago that photosynthesis of even many tropical shade plants and plants of moist, protected habitats, is entirely inhibited by prolonged exposure to full sunlight. Tests conducted at the College of Agriculture during the summer of 1918 on photosynthesis of even as hardy a plant as the coconut showed that its rate was reduced by more than one half during the hours from 10 a. m. to 2 p. m. on sunny days in May. Similar results were obtained with abaca, but sugar cane was not so affected. Many more examples might be cited, but these illustrate the importance of the study of light and its effects on growing crops. Measurements of the intensity of solar insolation in the tropics are somewhat meager, and we may therefore look forward with anticipation to the publication of the calendar physheliometer records being made at the Manila Observatory under the direction of Reverend José Algué.

Rainfall is fully as important as sunlight intensity, and even more important in its effect on plants. Indeed, the two are closely linked in their influence, since the extreme intensity of the sunlight and the high rates of evaporation from both plants and soil, make necessary large amounts of water for crops during sunny weather. As a conse

quence, any month with less than five centimeters of rainfall is distinctly and harmfully dry in the Philippines, while five centimeters (2½ inches) a month is considered an abundance for most crops in temperate regions. Some tropical crops seem to require an even higher minimum than five centimeters per month for good production. On the other hand, maize, sugar cane, mangos, naranjitas, and several other crops are distinctly benefited by periods of drought. So it is evident that to grow a crop to the best advantage, it is important to study the moisture requirements of each crop, as well as the monthly and, in some cases, even the weekly distribution of rainfall. A study of the seasonal influences on lowland rice at the College of Agriculture during 1916-1917 by Peralta,[1] clearly indicated an annual cycle in rice, the best crops resulting from planting in April, May and June. This apparently coincided with the period of highest evaporation intensity and warm weather. Since this crop is irrigated and kept flooded, rainfall could not exert any marked influence on the growth. This result of Peralta's is further confirmed by other cultures of rice initiated for other purposes. All agree in showing that April and May plantings in this locality are better than rice plantings of the same variety in August and September. This result is given in detail to emphasize the importance of studying both rainfall and evaporation in connection with crop production.

The publications of the Philippine Weather Bureau give the general distribution of rainfall in the Philippines in a most satisfactory manner, and also indicate very clearly the extreme local variations caused by lakes, mountains, etc. An equally thorough-going study of evaporation from standardized instruments, designed to relate the results to plant growth, would be a very helpful aid in interpreting the moisture conditions affecting vegetation throughout the Philippines. A few such records from Livingston standard atmometers have been reported from Los Baños.[2] These are, however, of purely local value, and the only comparable readings are reported from England and the United States. Brown has shown for Mt. Maquiling, in the Philippines, that the size of vegetation is directly correlated with the intensity of evaporation. Whether or not evaporation is in itself the primary controlling factor or is itself controlled by some other condition similarly affecting plant life is not clear. Indeed evaporation, is similarly influenced by such diverse conditions as insolation, humidity, wind, temperature and atmospheric pressure. But whatever its scientific value as a measure of the several primary factors composing climate, the practical value of evaporation for the understanding of plant growth is very obvious. This has proved true whenever it has been seriously studied in the United States, in England and in the Philippines.

The underlying reason for the extreme importance of evaporation to plant life is self-evident. Most plants are eminently fitted to lose water rapidly from their leaves, at the same time they are actively absorbing carbon dioxide and evolving oxygen during photosynthesis. The leaf structures favoring the one also permit the other. But rapid evaporation, though it may be beneficial, is often injurious or may even be fatal to plants. Hence the importance of knowledge of this climatic factor—evaporation. Humidity, so very important a factor in human welfare,

[1] The Philippine Agriculturist 7: 159-183. 1919.

[2] See W. H. Brown, various articles in the Phil. Jour. of Science and the Phil. Agr. & Forester, 1917-1918.

has been proved to affect plants only to the extent of its influence on evaporation.

Another factor, of tremendous local interest and importance, is wind. Its destructive force in typhoons needs no comment here. The effects of more moderate, long-continued winds, such as frequently occur during the early months of the northeast trade winds, are, however, worthy of extended study. Their effects on evaporation, and consequently on growth are very marked. Repeated observations on growth of individual plants at the College have shown that winds may retard the growth of many common tropical plants. This retardation, however, may be beneficial rather than harmful in the case of some crops, inducing the plants to set flowers and fruits more abundantly than under more favorable growth conditions. However, the effects of such conditions on the time and abundance of fruit production is not fully understood at the present time.

The range of observed conditions is from a mean temperature of 26.8°C at Manila to 17.8°C at Baguio, and from 400 centimeters rainfall in nine months at Baguio, to a six months' drought and 280 to 350 centimeters rainfall in northeastern Luzon. There are all intermediate conditions from the extremely long dry season to the region of uniform rainfall in the eastern and southern portions of the Archipelago, where there is no dry season and the annual rainfall ranges at different stations from 92.5 centimeters to nearly 400 centimeters. Baguio thus furnishes conditions comparable to those of the high mountains of southern India, Ceylon and the Malayan Archipelago, the higher mountain of western Africa bordering the gulf of Guinea, southern Queensland in Australia, the Hawaiian volcanoes, the mountains of southeastern Mexico, Central America and the northern Andean region.

The great variety of climatic conditions to be found in the mountains and lowlands of the Philippines makes a study of climatology especially profitable for Philippine students of agriculture.

Annual climatic conditions to duplicate almost any locality in the tropical world can be found within our borders. Only the driest, hottest regions, such as northern Africa and western South America, and the climates with double rainfall periods on the equator cannot be duplicated in the Philippines. Again, if we consider annual crops of five months or less in duration, a majority of the temperate crops can be successfully grown in favored localities. Of these one need only mention the vegetable gardens of Baguio and the peas of Mariquina valley as examples. There are excellent opportunities for developing local industries in special crops of both tropical and temperate origin. These await upon a thorough study of local climatic and soil conditions. Even where soil conditions appear unfavorable, such drawbacks can be minimized by proper cultural methods. The weather conditions cannot be thus improved in field culture and should therefore be a primary consideration in choosing a new farm location or selecting suitable crops for any locality.

In view of the importance of this subject, it is highly desirable that a course of instruction in this subject be given at the College of Agriculture. An outline for such a course has already been prepared.

The Preservation of Eggs[1]

By José Mariano y Garcia

INTRODUCTION

Of the valuable items entering into the human dietary, possibly one of the commonest and cheapest is the hen's egg. Its usefulness is such that it can serve as a substitute for meat.

The contents of the egg are designed especially to supply the necessary materials for growth and development of the young individual for a considerable time, and such being the case, it is obvious that it must contain all the elements necessary in the chicken's metabolism. For this reason, it is not strange that it should be an excellent article of food. However, the elements the egg contains are not in the proportion suitable for the sole nourishment of an adult individual. [2]

COOKING AND SERVING EGGS

Eggs may be eaten raw, whole, or either beaten or stirred. They may be cooked in different ways; and by so doing, they undergo marked changes in their appearance and structure. They may be cooked simply by immersion in hot or boiling water, or by placing them on hot soft rice, or the like. The resulting product will depend on the length of time the cooking is prolonged, the method of procedure, etc. Eggs immersed in boiling water for about two minutes will assume a thin coating of coagulated white next to the shell; the rest of the albumen will be milky but not solid; while the yolk, though warm, will be entirely fluid. This stage may be termed "very soft boiled." If eggs are cooked in boiling water two minutes or a little over, the albumen becomes entirely coagulated. This condition may be termed "waxy". If the boiling is continued to three minutes or so, the eggs will tend to float on the water and will become tough throughout. Such may be called "solid boiled." If the eggs are kept in the process up to ten minutes or longer, the albumen becomes hard and elastic, while the yolk crumbles readily. This stage may be termed "hard boiled." Eggs may also be baked, steamed, or fried.

In the case of "solid boiled" and "hard boiled," after the eggs are removed from the shell, they may be cut into slices and combined with other materials to form various dishes. Such slices are often used for garnishing or ornamenting different food preparations. Raw eggs are also used in making cakes and other kinds of bread to improve their flavor, color and texture. The white part, or the albumen, of eggs is very useful in making icings and confectionery.

DISTRIBUTION OF EGGS

In the Philippine Islands no specific egg-producing section has ever been recognized. It is presumed that eggs are produced from every small poultry-stock kept by farmers and others. In general, eggs are fairly abundant in Luzon and in the Visayan Islands, while they are rather scarce in Mindanao.

Manila and probably other seaports get a large amount of their egg supply from China, but in the provinces, Chinese eggs are rarely sold.

Eggs have been observed to be rather plentiful in the different local markets during the months of December, January, February, March and April. These months fall within the drier part of the year. Also, the harvesting and the threshing of rice in nearly all the provinces in the Philippines occur during these months. The Philippine chicken

(1) Thesis presented for graduation from the College of Agriculture, No. 102; Experiment Station Contribution No. 5.

(2) Langworthy, C. F., *Eggs and their Uses as Food. U. S. Dept. of Agr., Farmers' Bull. No. 128.*

does not usually get either regular or systematic feeding, but has to forage for most of its food. Refuse grains being more plentiful at this time of the year, the chicken not only gets more feed but not having had regular feed before this, might be stimulated to greater production.

There are also other reasons why eggs are scarce at certain months of the year. It is the common practice of the native poultry keepers to set their hens from the beginning of July up to November. During these months eggs are very expensive. Again, it may be due to the molting of the hens which generally takes place at about this time, and, consequently, hens lay poorly for a while while they prepare themselves for the new feathers. In the towns of Los Baños, Calamba, and Bay in Laguna and nearly all the towns in Bulacan, as well as Batangas, Rizal, Cavite, Pampanga, etc., eggs are exceptionally scarce during the month of August.

The preservation of eggs in the home during the months of December, January, February, March, April, May and June seems expedient, because eggs are rather plentiful during these months; they sell at a low price, from two to three centavos each. Eggs during the other months are rather scarce and sell at from three and a half to five centavos each.

OBJECTS

The objects of the present experiments are: (*a*) to study a few methods of preserving eggs and their adaptability to Philippine conditions, that is, of climate, surroundings, and genera practicability; and (*b*) to make some observations on the behavior of chickens in pens with and without males as regards feeding, egg production, etc.

PREVIOUS WORK ON THE SUBJECT

The *Berliner Markthallenzeitung*, quoted by Watson, (1) "reports about experiments made for the purpose of securing the most rational method of preserving eggs. Twenty methods were selected for these experiments. In the first days of July, four hundred fresh eggs were prepared according to these methods (twenty eggs for each method) to be opened for use at the end of the month of February. After eight months of preservation, the eggs were opened for use and the twenty methods employed gave the most heterogeneous results.

"1. Eggs put for preservation in salt water were all bad.

2. Eggs wrapped in paper, 80% bad.

3. Eggs in a solution of salicylic acid and glycerin, 80% bad.

4. Eggs rubbed with salt, 70% bad.

5. Eggs preserved in bran, 70% bad.

6. Eggs provided with a cover of paraffin, 70% bad.

7. Eggs varnished with a solution of glycerin and salicylic acid, 70% bad.

8. Eggs put in boiling water for twelve to fifteen seconds, 50% bad.

9. Eggs treated with a solution of alum, 50% bad.

10. Eggs put in a solution of salicylic acid, 50% bad.

11. Eggs varnished with waterglass, 40% bad.

12. Eggs covered with lac, 40% bad.

13. Eggs varnished with collodin, 40% bad.

14. Eggs varnished with sward, 20% bad.

15. Eggs preserved in wood ashes, 20% bad.

(1) Watson, G. C., *Farm Poultry:* 322—326. 1912.

16. Eggs treated with boric acid and waterglass, 20% bad.

17. Eggs treated with manganate of potash, 20% bad.

18. Eggs varnished with vaseline, all good.

19. Eggs preserved in limewater, all good.

20. Eggs preserved in a solution of waterglass, all good."

"The last three methods are consequently to be considered the best ones, especially the preservation in a solution of waterglass, as varnishing the eggs with vaseline takes too much time, and the treatment with lime water sometimes communicates to the eggs a disagreeable odor."

In the experiments of Jarvis [1], of the Ontario Experiment Farm, limewater and waterglass solutions were found to be good as egg preservatives. He used a solution containing one part to fifteen parts of water, and also a one to twenty dilution, and under such conditions both gave satisfactory results.

Shutt [2], of the Dominion Experiment Farm, pointed out in 1899 that limewater was the best preservative. The preservatives he tested for comparison were waterglass solution, glycerin and pure distilled water, as well as the proposed method of coating the eggs with paraffin. In conclusion, he says; "As far as my experience goes, no other fluid (limewater) is its equal, the eggs from the preservative being far and away superior to those kept by the other methods here stated."

According to Gilbert [3], limewater proved satisfactory as an egg preservative. A solution containing 5% of gum arabic and either 1% of formalin or 5% of salicylic acid kept eggs from decay; eggs in this condition developed a strong, disagreeable taste when cooked.

Ladd [1], in his experiments conducted in 1900, found that a 10% waterglass solution preserved eggs very well. The two seasons' trials made by himself and under his direction gave uniformly good results, if fresh eggs were used.

At the Montana Experiment Station, Gardiner [1] made several tests of the relative value of a lime-and-salt mixture and waterglass as egg preservatives. The proportion of waterglass was one to eighteen dilution. By these methods eggs were observed to be difficult to distinguish from fresh eggs after six months.

Brigham [2], of the Rhode Island Experiment Station, concluded from his experiments conducted in 1901 that of eggs kept for 10.5 months in (1) 10% waterglass solution, (2) dry table salt, (3) slaked lime and salt brine, (4) vaseline, (5) dry wood ashes, (6) finely ground gypsum, (7) powdered sulphur, (8) brimstone fumes and sulphur, (9) potassium permanganate, (10) salicylic acid, and (11) salt brine, only (1) and (3) were found to be in good condition, while (4) would probably have proved satisfactory for a short period of time and (2) is worthy of recommendation for only a few months' preservation.

W. R. Graham [3], of the Ontario Agricultural College, in his experiments with waterglass found that in a 1:5 dilution, the eggs scored 44 out of a possible 50. Where waterglass was 1:7 dilution, the eggs scored 43.2 out of 50. With lime and salt solution the eggs scored 40, and in lime water they scored 38.

A. E. Bowman[4] writes the following: "Eggs may be preserved for years and

1 Quoted by Pullman in Washington Experiment Station Bull. No. 71: 6. 1905.
2 Quoted by Pullman in Washington Experiment Station Bull. No. 71: 6. 1905.
3 Quoted by Pullman in Washington Experiment Station Bull. No. 71: 7. 1905.

1 Quoted by Pullman in Washington Experiment Station Bull. No. 71: 7. 1905.
2 Quoted by Pullman in Washington Experiment Station, Bull. No. 71: 8. 1905.
3 Utah Agricultural Experiment Station, Circ. No. 25: 4. 1917.
(4) The Wyoming Farm Bull., Vol. 6, No. 2, p. 22. 1916.

yet be sufficiently fresh for cooking. It is often impossible to distinguish eggs preserved in waterglass from eggs only six or seven days old; in fact, if properly done, the preserved eggs are often superior to the apparently fresh eggs; as for instance, when the latter has been exposed to a warm August sun during the greater part of the time intervening between laying and marketing."

J. Hendrick (5), of the University of Aberdeen, preserved 384 dozen eggs in a waterglass solution between April and June and sold them between October and December. All the eggs preserved by this method were found to be of good quality. They were two or three days old before being put in the preservative. Of 384 dozen eggs, only 5 dozen, or 1.3%, were bad, and the majority of these 5 dozen, were broken or cracked.

The eggs which were preserved in waterglass solution, according to the same author, usually "have a nice appearance, as shells are very clean and fresh looking after the waterglass is wiped off. Even those which had been several years in water glass had a fine fresh appearance. Another advantage of preservation in waterglass over certain other methods is that the contents of the eggs do not shrink to evaporation. The eggs, therefore, do not rattle when shaken, no matter how old they are. The cost of preservation is very small."

G. Arthur Bell (1) was very favorably impressed with the value of waterglass prepared by mixing 1 quart of this substance with 15 or 20 quarts of clean boiled water. He says: "Of the methods which have been tried for preserving eggs on a small scale, none has proved more successful than the use of waterglass." To this he adds: "Eggs can be preserved for several months in dry salt. Packing in bran has also been found satisfactory in many cases."

Water-glass (sodium silicate) has been very generally tried for several years and it is now recommended as being the best preservative for those who would preserve a small number of eggs for home use." (2) The proportion used by Lamson was 1 gallon of waterglass to 10 gallons of water.

THE PRESENT STUDY

PART I

PRESERVATION OF EGGS

To furnish eggs from day to day for this experiment, three pens were kept. The discussion about these is taken up in Experiment II on "Some Observations on the Behavior of Chickens as Regards Feeding, Egg Production, etc." Previous experimenters have used fresh eggs and put them in the preservatives all at one time. In the present experiment, eggs were preserved from day to day, as they were collected, a condition which one is more likely to meet in the home.

In this experiment 13 different preservatives were used. The kinds of preservatives, dates of preservation and the total numbers of eggs used in each case are given in Table I.

(5) U. S. Dept. of Agr. Bull. No. 296: 29-30 1907.
(1) U. S. Dept. of Agr. Bull. No. 287: 41-42. 1907
(2) Storrs Agricultural Experiment Station. Bull. No. 67: 269. 1911.

TABLE I

	Preservatives	Date of Preserving	No. of Eggs Preserved
1.	Water diluted molasses	March 1-2	12
2.	Molasses alone	March 1-Aug. 3	62
3.	5% salt solution	March 1-31	46
4.	Limewater	March 3-July 3	154
5.	Vaseline	March 5-Oct. 27	91
6.	5% water-glass solution	April 7-Oct. 31	65
7.	Dry common salt (NaCl)	April 26-July 15	50
8.	Rice bran	April 29-July 9	49
9.	10% water glass sol.	May 4-Oct. 30	77
10.	Salt and sand mixture	Aug. 7-19	13
11.	10% salt solution	Aug. 21-Sept. 3	23
12.	Water cooling	Sept. 5-18	23
13.	Dry lime	Sept. 19-26	17
14.	Check. No preservative	March 7-Oct. 11	30
	Total		712

EXPERIMENTAL WORK

Former experimenters on preservation noted the condition of the egg contents as either raw or cooked; but no attempt was made to describe the amount, flavor, texture, smell, etc. of the albumen and yolk of the preserved eggs before and after being boiled or fried. This phase is emphasized in the present experiments.

For the sake of convenience, the preparation of the preservative used here, as well as the method of packing eggs in each preservative and the description of the eggs tested from time to time, are separately considered, as follows:

DILUTED MOLASSES

Molasses - - - - -	1 liter
Water - - - - - -	5 liters

This mixture was prepared to lessen the density of molasses in such a way that the eggs may not float. The mixture was placed in a glass receptacle and stirred thoroughly before the eggs were preserved. Twelve eggs were packed in the solution, between March 1 and March 2, 1917. The vessel was kept covered and placed in a cool room.

On March 6, four days after the preservation experiments began all eggs were found floating and were soft to the touch. The solution was fermenting and sour. Two eggs were removed for examination. The results were as follows:

Raw:

0-1 * (March 1)

Age—5 days

Shell—mineral matter disintegrated, and only the outer shell membrane remaining.

Outer albumen-watery; dark brown; smell and taste of sour molasses.

Thicker albumen—shrunken; color and smell, same as above.

Yolk—stood up well; taste, as above.

Boiled:

Shell—outer shell membrane, soft.

Albumen—partly liquid and partly solid; dark brown; taste, slightly bitter and smell, like molasses.

Yolk—partly solidified; texture, soft; taste, like molasses.

On March 24, six eggs were examined. By this time, they were observed to have swollen very much.

Raw:

Shell—same as above

Albumen—very watery; darkish brown; sour.

Yolk—disintegrated and mixed with the albumen; sour.

Boiled:

Shell—soft, as before being boiled.

Albumen—very watery and partly solidified; taste, very unpleasant.

Yolk—hardly solidified; disintegrated.

The remaining four eggs in the solution were thrown away.

CONCENTRATED MOLASSES

This preservative involved no preparation. About eight liters of fresh sugar-cane molasses was bought for 50 centavos, and put in a painted petroleum can. From time to time, between March 1 and August 3, 1917, 62 eggs were placed in the vessel. As eggs were found to float on the liquid a piece of wooven bamboo was used to keep them immersed.

On March 31 and July 25, 1917, eight eggs were examined for a one-month test.

Raw:

P-4 (March 1), 0-6, 0-10, P-8 (July 26), air cell small.

Age—about 1 month.

Shell—slightly covered with minute brown spots, otherwise normal.

Outer albumen—slightly shrunken.

Thicker albumen—slightly shrunken; smell, normal.

* Egg number.

Yolk—stood up well; smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, slightly acid; texture, soft.

Boiled:

P-5, P-8 and 0-10 (July 28), P-3.

Age—about 1 month.

Shell—same as raw; but color faded.

Albumen—taste, normal; texture, somewhat tough.

Yolk—taste, slightly sweet; texture, crumbled.

There were 4 eggs designated as 0-4, 0-5, 0-10 (March 3), P-8 (March 4), tested on April 30, 1917.

Raw:

0-5, 0-10; air cell small.

Age—about 2 months.

Shell—heavily covered with brown spots.

Outer albumen somewhat shrunken.

Thicker albumen—shrunken; smell, normal.

Yolk—stood up well; slightly shrunken; smell, normal.

Fried:

Albumen—taste, slightly molasses-like; texture, soft.

Yolk—taste, slightly acid; texture soft.

Boiled:

0-4, P-8.

Shell—brown spots, hardly removable.

Albumen—taste, slightly molasses-like; texture, soft.

Yolk—taste, like boiled green corn; texture, hard and crumbly.

Eight eggs were opened for a 3-month test on September 30, 1917.

Raw:

0-6 (July 30), R-2 (August 2, 3 and 5); air cell large.

Shell—heavily covered with brown tint.

Outer albumen—shrunken.

Thicker albumen—shrunken; smell, s ightly sour.

Yolk—stood up wel' but shrunken; smell, slightly sour; rather solid.

Fried:

Albumen—taste, slightly molasses-like; texture hard and tough.

Yolk—taste, somewha molasses-like; texture soft.

Boiled:

P-3 (July 30), 0-6, 0-10 (July 31), 0-6 (Aug. 2).

Shell—as in raw.

Albumen—taste, slightly sour and slightly molasses-like; texture, somewhat curdy.

Yolk—taste, like boiled green corn; texture, hard and crumbly.

On July 12, 1917, twelve eggs were opened for a 4-month test.

Raw:

6 eggs; air cell very large.

Shell—corroded.

Outer albumen—dense and shrunken.

Thicker albumen—very dense and shrunken, appearing thus in lesser quantity; color, light brown.

Yolk—hard, sticky and tough and very cohesive; smell, like sour molasses.

Fried:

Albumen—taste, like molasses; texture, very tough and hard.

Yolk—taste, slightly sweet, like that of boiled green corn.

Boiled:

6 eggs; air cell, very large.

Shell—brown in boiling water.

Albumen—Taste, slightly molasses-like; texture, tough, hard and easily dried up.

Yolk—taste, like boiled green corn; texture, spongy and hard.

On September 15, 1917, all eggs preserved in sugar-cane molasses were opened for a 7-month test. They numbered 30. One-half of this number was opened raw to examine the condition of the albumen and yolk of the

individual eggs. The results were as follows:

Raw:

R-4, R-9, R-10 (March 5); R-3, R-4, R-10 (March 6); P-3, P-6, 0-5, R-2, R-6, R-10 (March 27), P-3, R-4 (March 28); R-10 (March 29).

Shell—corroded, and, after washing with water, appeared very old; air cell, very large.

Albumen—in all cases, dense; color, pale brown; so thickened in sprinkling that it could hardly flow away from the yolk.

Yolk—shrunken; in all cases, brownish yellow; smell, molasses-like; texture, sticky and tough.

Fried:

Albumen—taste, molasses-like; texture, brittle and tough. It was easily cooked; made the lard spatter.

Yolk—took time to cook well; taste, like boiled green corn; texture, hard and spongy.

Boiled:

P-3, 0-1, 0-9, R-1, R-8 (March 14); 0-8, R-2, R-5, R-7, R-9 (March 15); 0-9, R-1, (March 16); P-2 (March 27); P-9, P-10 (March 8).

Shell—in all cases, covered with minute darkish brown spots even after being washed well with water; contents, shrunken to less than half the normal content.

Albumen—taste, somewhat molasses like; texture, hard and very tough. It adhered almost firmly to the shell in all cases.

Yolk—taste, sweet, like boiled green corn; texture, hard and crumbly.

FIVE PER CENT COMMON-SALT SOLUTION

Common salt - - - 50 grams
Water - - - - - - 1 liter

This solution was prepared by dissolving 50 grams of common salt in one liter of water previously boiled and cooled, and then stirred thoroughly until all particles of salt were dissolved. The solution was strained through a piece of cheese-cloth to obtain the clear liquid. Six liters of this solution were used and put in a painted petroleum can. Between March 1 and March 31, 1917, forty-five eggs were preserved. The container was kept in a cool room having a temperature of from 27° to 29° C and covered all the time.

On March 31, two eggs were opened for a one-month test. The results were as follows:

Raw:

0-7

Shell—normal; air cell, normal.

Outer albumen—normal

Thicker albumen—normal

Yolk—stood up well; very slightly shrunken; smell, normal.

Fried:

Albumen—taste, slightly salty; texture, normal.

Yolk—taste, slightly salty; texture, normal.

Boiled:

P-8.

Shell—normal

Albumen—taste, slightly salty; texture, normal.

Yolk—taste, slightly salty; texture, hard and spongy, normal.

On May 4 and 11, 1917, nine eggs were opened for a two-month test. The results were as follows:

Raw:

R-10 (March 4); 0-2, 0-X, P-5, P-9 (March 10).

Shell—slightly corroded; air cell, normal.

Outer albumen—watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well in all cases; slightly shrunken; smell, normal.

Fried:

Albumen—taste, salty; texture, soft and wrinkled.

Yolk—taste, somewhat salty; texture, somewhat hard and crumbly.

Boiled:

R-3 (March 4); 0-6, R-2, P-8 (March 10).

Shell—corroded; color, faded.

Albumen—taste, salty; texture, soft and curdy; smell, normal.

Yolk—taste, somewhat salty; texture, hard and crumbly.

On June 25, 1917, all eggs were removed from the solution, for they were found to be rotting. The paint of the container was dissolved and mixed with the solution, thus making it dirty. Nearly all eggs emitted a bad odor.

LIMEWATER

Quicklime - - -	1 kilogram
Water - - - - - -	9.5 liters

This preservative will probably be found to be the most economical and readily adaptable to Philippine conditions. It is prepared as follows: Shake 1 kilogram of quicklime in 9.5 liters of water. Stir the mixture thoroughly for some time, then allow the sediment to settle. Pour off the liquid into a receptacle, preferably an earthenware jar. This should be covered and kept in a cool place. It is best to have the water boiled and cooled before using. The eggs collected from day to day may be placed in this solution.

When limewater was put in a painted can, it did not preserve the eggs longer than 3 months. On March 2, 1917, 9.5 liters of this solution were prepared and put in a receptacle of the kind mentioned. Between March 3 and April 8, 1917, 60 eggs were placed in the vessel. On March 31, about one month after preservation began, eggs P-6 and P-9 (March 4) were opened for examination. The results were as follows:

Raw:

P-6

Shell—normal.

Outer albumen—normal.

Thicker albumen—normal.

Yolk—stood up well; smell, normal.

Fried:

Albumen—flavor, normal; texture, soft.

Yolk—flavor, normal; texture, soft.

Boiled:

P-9

Shell—normal; air cell, small.

Albumen—taste, normal; texture, normal.

Yolk—taste, normal; texture, soft.

On May 4, 1917, four eggs were opened for examination. The results were as follows:

Raw:

P-9, 0-10 (March 4).

Age—about 2 months.

Shell—apparently clean.

Outer albumen—normal.

Thicker albumen—normal; smell, normal.

Yolk—stood up well; very slightly shrunken; smell, normal.

Fried:

Albumen—taste, very slightly chalky; texture, normal.

Yolk—taste, normal; texture, normal.

Boiled:

P-10, P-X (March 4).

Shell—normal; air cell, small.

Albumen—very slightly chalky; texture, normal.

Yolk—taste, normal; texture, medium hard and crumbly.

On June 6, the solution was found to have a pale green color. It gave off an unpleasant odor, due to the paint dissolving and mixing with the solution, thus making the contents of the egg deteriorate. Eggs 0-2, 0-8 (March 5); 0-1, R-8, R-9 (March 16), 0-X, R-8 (March 18), P-2, 0-5 (March 24), P-3 (April 1) were removed from the solution to be examined. The results were as follows:

Raw:

P-2 (March 24), R-8 (March 18), P-3 (April 1).

Age—between 2 and 3 months.

Shell—covered with pale green; easily removed after washing with water; smell, unpleasant.

Outer albumen—watery.

Thicker albumen—shrunken.

Yolk—disintegrated and mixed with the albumen; smell, putrid.

Boiled:

(Seven eggs.)

Age—about 3 months.

Shell—looked old; smell, bad.

Albumen—taste, somewhat bitter; smell, putrid; texture, curdy; color, gray.

Yolk—taste, unpleasant; smell, bad; texture, sticky; color, dark brown.

By this time, the remaining eggs in the solution were thrown away as rotten eggs.

On June 10, 9.5 liters of limewater were again prepared, and put in a china jar. Between June 11 and July 3, 1917, 94 eggs were placed in the solution and the receptacle was covered.

On September 22, the following eggs were examined:

Raw:

P-5, 0-1, R-8 (June 22).

Age—3 months.

Shell—normal; air cell, normal.

Outer albumen—slightly watery.

Thicker albumen—rather shrunken; smell, normal.

Yolk—shrunken; smell, normal.

Fried:

Albumen—taste, slightly chalky; texture, fine.

Yolk—taste, normal; texture, fine.

Boiled:

0-3, 0-5, 0-8, R-1 (June 22).

Shell—normal.

Albumen—taste, slightly chalky; texture, normal.

Yolk—taste, normal; texture, hard and crumbly.

On October 16, 1917, eight eggs were tested. The results were as follows:

Raw:

P-10, 0-5, R-8, R-9 (June 15).

Age—about 4 months.

Shell—normal; air cell, small.

Outer albumen—somewhat watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well; slightly shrunken; smell, normal.

Fried:

Albumen—taste, slightly chalky; texture, soft.

Yolk—taste, normal, texure, normal.

Boiled:

0-5, 0-8, R-5, R-8 (June 16).

Shell—normal; air cell, small.

Albumen—taste, slightly chalky; texture, normal.

Yolk—taste, normal: texture, somewhat hard and crumbly.

On November 6, the following results were obtained:

Raw:

P-4, P-8, P-X, R-7 (June 11).

Age—about 5 months.

Shell—nice and very clean; air cell, normal.

Outer albumen—watery.

Thicker albumen—somewhat shrunken; smell, normal.

Yolk—stood up well; smell, normal and somewhat shrunken.

Fried:

Albumen—taste, slightly chalky; texture, normal.

Yolk—taste, normal, texture, soft.

Boiled:

P-4, 0-8, R-5, R-9 (June 12).

Shell—normal and appeared very clean.

Albumen—taste, slightly chalky; texture, normal.

Yolk—taste, normal; texture, tough and spongy.

The following eggs were opened raw

on December 7, 1917, as exhibits in the College Exposition. They were P-10, 0-3, R-9 (June 13).

Age—about 6 months.

Shell—normal; looked very clean.

Outer albumen—watery.

Thicker albumen—rather shrunken; smell, normal.

Yolk—stood up well; slightly shrunken.

On December 19, twelve eggs were tested. The results were as follows:

Raw:

0-3, R-1, R-6, R-8 (June 19); R6-(June 18), 0-9 (June 17).

Age—about 6 months.

Shell—normal, looked clean; air cell, normal.

Outer albumen—watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well in all cases, except R-1 which broke after being dropped on the plate, but smell and flavor were normal.

Fried:

Albumen—taste, slightly chalky; texture, normal.

Yolk—taste, normal; texture, soft.

Boiled:

P-8, P-10, R-6 (June 17); 0-5, 0-8 (June 18); P-1 (June 19).

Shell—appeared fine and clean.

Albumen—taste, somewhat chalky; texture, somewhat soft.

Yolk—taste, very slightly chalky; texture, rather hard and spongy.

On January 23, 1918, 24 eggs were examined.

Raw:

P-5, 0-1, 0-3, 0-5, 0-8, 0-X (June 20) P-1, 0-1, 0-3, 0-5, R-1, R-8 (June 21).

Age—about 7 months.

Shell—0-3 (June 20) was found to be broken lengthwise. In all cases looked nice and clean.

Outer albumen—watery.

Thicker albumen—shrunken; smell, normal.

Yolk—0-X, 0-8 (June 21) had weak vitelline membrane; smell, normal. In all other cases the yolk stood well but was slightly shrunken.

Fried:

Albumen—taste, somewhat chalky; texture, soft.

Yolk—taste, slightly chalky.

Boiled:

P-5, 0-1, 0-3, 0-5, 0-8, R-1, R-8 (June 22); P-5, P-X, 0-3, 0-9, 0-X (June 23).

Shell—nice and clean.

Albumen—taste, slightly chalky; remained soft curd after boiling for ten minutes.

Yolk—taste, somewhat chalky; texture, rather soft.

On February 28, 1918, the following eggs were tested and the results were as follows:

Raw:

16 eggs—P-5, 0-3, 0-5, 0-8, 0-9 (June 25); P-1, P-5, 0-1, 0-3 (June 26); R-5 (June 13); P-8 (June 19); P-6, R-4 (June 27); 0-10, R-5 (July 2); R-1 (July 3).

Age—about 8 months.

Shell—nice and clean; air cell, normal.

Outer albumen—watery.

Thicker albumen—rather compact; shrunken.

Yolk—R-5 (June 13); 0-5, 0-3 (June 25); 0-3 (June 26). Yolk, broken; smell, normal.

Fried:

Albumen—taste, somewhat chalky; texture, soft.

Yolk—taste, slightly chalky; texture, soft. The broken ones coagulated to a pale yellow curd because of the albumen.

Boiled:

18 eggs—P-1, 0-1, 0-5 (June 24); 0-6, 0-9, 0-10, R-4 (June 26); P-5,

P-6, 0-6, 0-X, R-4, R-X (June 28); 0-5 (June 29); P-6, 0-6, R-1 (June 30); P-6 (July 1).

Shell—nice and clean; air cell, normal. 0-5 (June 29); P-6, R-1 (June 30) cracked during boiling, though they have been punctured with a small needle at the air-cell end.

Albumen—taste, slightly chalky; texture rather soft curd; smell, normal.

Yolk—taste, somewhat chalky; texture, rather soft; smell, normal.

VASELINE

Vaseline has been used as an egg preservative for many years. The operation involved is simply coating the eggs with vaseline. Such a method is easy of application, but it takes much time. In the present experiments, plain cosmoline was used. Between March 5, and October 27, 1917, ninety-one eggs were varnished uniformly with the finger and placed in earthenware jars. A clean piece of paper was put above the upper layer of eggs so as to keep the eggs free from dust. The receptacle was covered with a good lid and kept in a cool place.

On March 31, 1917, 2 eggs were opened for examination. The results were as follows:

Raw:

P-6 (March 5).

Age—nearly one month.

Shell—smooth and oily even after being cleaned with a piece of cheese cloth; air cell, normal.

Outer albumen—normal.

Thicker albumen—normal; smell, normal.

Yolk—stood up well; very slightly shrunken; smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal; texture, normal.

Boiled:

0-9 (March 6).

Age—nearly one month.

Shell—remained smooth and oily.

Albumen—taste, normal; texture, normal.

Yolk—taste, normal; texture, elastic and spongy.

On January 24, 1918, seven eggs were tested:

Raw:

R-5 (October 6), P-1, P-8 (October 10), P-8 (October 12).

Age—about 3 months.

Shell—smooth and oily; air cell small.

Outer albumen—normal in amount.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well; slightly shrunken smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal; texture, soft.

Boiled:

P-1 (October 8), P-8 (October 14), P-6 (October 27).

Age—about 3 months.

Shell—remained smooth and oily.

Albumen—taste, normal; texture, somewhat hard and elastic.

Yolk—taste, normal; texture, hard and crumbly.

On July 12 and October 16, 1917. 14 eggs were opened for a 4-month test, The results were as follows:

Raw:

0 2, 0 7, 0-8 (March 7), 0-4, R-7 March 13; R-9 (June 8); R-1 (June 10).

Shell—oily and appeared old; air cell, normal.

Outer albumen—inclined to be watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—slightly shrunken; 0-7, 0-4

and R-1—vitelline membranes easily broken; smell, normal. The rest stood up well.

Fried:

Albumen—taste, slightly wax-like; texture, soft.

Yolk—taste, slightly like vaseline; texture, soft.

Boiled:

P-5, 0-10 (March 6); P-3, P-8 (June 7); P-4, P-9 (June 8).

Shell—oily and looked old.

Albumen—taste, very slightly like vaseline.

Yolk—taste, somewhat like vaseline.

On August 3, three eggs were tested:

Raw:

0-3, 0-8 (March 14).

Age—about 5 months.

Shell—oily and dirty, but when cleaned, assumed its original appearance; air cell, normal.

Outer albumen—slightly watery.

Thicker albumen—slightly shrunken.

Yolk—slightly shrunken; stood up well; smell, normal.

Fried:

Albumen—taste, like vaseline; texture, soft.

Yolk—taste, slightly like vaseline; texture, soft.

Boiled:

R-9 (March 13).

Albumen—taste, slightly wax-like; texture, somewhat hard and elastic.

Yolk—taste, slightly like vaseline or olive oil; texture hard and crumbly.

On September 22, six eggs were opened ar a 6-month test. The results were fo follows:

Raw:

P-10, 0-3, R-5 (March 23).

Shell—oily and very smooth after cleaning; air cell, small.

Outer albumen—somewhat watery.

Thicker albumen—slightly disintegrated; smell, normal.

Yolk—R-5 had a weak membrane, easily broken and shrunken; smell, normal.

Fried:

Albumen—taste, slightly waxy; texture, soft.

Yolk—taste, slightly like vaseline; texture, soft.

Boiled:

R-5, R-9, R-6 (March 23).

Shell—oily and smooth.

Albumen—taste, slightly like vaseline; texture, somewhat hard and elastic.

Yolk—taste, slightly waxy; texture hard and crumbly.

On December 7, 1917, eggs P-3, P-10 and 0-2 (June 5) were opened raw and shown at the College Exposition. The results were as follows:

Raw:

Age—about 6 months.

Shell—oily and smooth after being cleaned; air cell, small.

Outer albumen—slightly watery.

Thicker albumen—slightly disintegrated; smell, normal.

Yolk—stood up well; slightly shrunken; smell, normal.

On October 24, five eggs were tested.

Raw:

R-6, R-2, R-9 (March 24).

Age —7 months.

Shell—oily and smooth; purple spots were present; air cell, small.

Outer albumen—watery.

Thicker albumen—partly disintegrated; smell, slightly sour.

Fried:

Albumen—taste, somewhat waxy; texture, soft and elastic.

Yolk—taste, like vaseline; texture soft; R-2 broken during frying.

Boiled:

P-10, R-6 (March 24).

Shell—oily and smooth; purple spots persistent.

Albumen—taste, slightly wax-like; texture, tough and elastic.

Yolk—taste, slightly sour or acid; texture somewhat soft but spongy.

On January 15, 1918, sixteen eggs were opened:

Raw:

P-6, 0-5 0-9, 0-10 R-10 (May 29); R-2, R-10 (May 30); R-10 (May 31).

Age—about 7½ months.

Shell—oily and smooth; streaked with purple spots.

Outer albumen—watery.

Thicker albumen—watery; smell, slightly sour.

Yolk—P-6, 0-10 and R-10—vitelline membrane, easily broken; smell, somewhat sour.

Fried:

Albumen—taste, slightly like vaseline; texture, elastic.

Yolk—taste, slightly like vaseline; texture, soft. R-10 (May 31) broken during frying.

Boiled:

0-2, R-2, R-5 (May 28), P-9, 0-2, 0-10, R-4, R-2 (May 30).

Age—about 7½ months.

Shell—oily and smooth.

Albumen—taste slightly like vaseline; texture somewhat hard and elastic.

Yolk—taste sour and slightly like olive oil; texture, somewhat soft and spongy.

On January 25, 1918, nineteen eggs were opened for a 8-month test. The results were as follows:

Raw:

P-9, 0-9 (June 2), P-10, R-3, R-9, R-10 (June 3), P-4, P-9, P-10 (June 6).

Shell—oily and smooth and looked old; most of them were st eaked with purple spots, air cell, small.

Outer albumen—watery.

Thicker albumen—partly desintegrated, smell, silghtly sour.

Yolk—P-10 (June 3 and 6), R-9, R-10 (June 3) vitelline membrane, very weak, smell, sour.

Fried:

Albumen—taste, slightly waxy; texture, hard and elastic.

Yolk—took some time to be well fried. Some of the yolks could hardly stand up well during frying and were broken. Taste, slightly sour and waxy.

Boiled:

P-9, R-3, R-10 (June 1); 0-2, R-2, R-3 (June 2), 0-2 (June 3); P-9, 0-9, (June 4).

Shell—oily and smooth, and with purple spots.

Albumen—taste, slightly wax-like; hard and elastic.

Yolk—taste, slightly sour and wax-like; texture, soft and sticky.

On December 11, 1917, 12 eggs were opened for a 9-month test. The results were as follows:

Raw:

P-9, 0-1 (March 6), 0-1, 0-3, 0-9 (March 12).

Shell—oily and smooth; streaked with purple spots; air cell, small.

Outer albumen—watery; pale brown.

Thicker albumen—slightly disintegrated; smell, slightly sour.

Yolk—0-1 (March 6), 0-1 (March 12) and 0-9 had weak vitalline membrane; smell, slightly sour in all cases.

Fried:

Albumen—small in amount; taste, slightly wax-like; texture, elastic.

Yolk—broken during frying in all cases; taste, like olive oil, sour and slightly wax-like.

Boiled:

0-4 (March 6), 0-1, R-1, R-4, R-5, R-9 (March 13).

Shell—oily and smooth; purple spots did not disappear; air cell, small.

Albumen—taste, slightly wax-like; texture, elastic.

Yolk—taste, slightly like vaseline and slightly sour; texture, somewhat soft and spongy.

DRY TABLE SALT (COARSE)

Salt (NaCl) was dried as thoroughly as possible in the sun before being used. It was placed in a tin receptacle. Between April 25 and July 15, 1917, 50 eggs were packed in the salt, leaving about 3 inches above the upper layer of eggs. The receptacle was covered and kept in the room. The following eggs were opened on August 25, 1917:

Raw:

P-4 (July 15), 0-X (July 14).

Age—about 1 month.

Shell—normal; air cell, large.

Outer albumen—normal.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—slightly shrunken; smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal; texture, soft.

Boiled:

P-8, R-3 (July 15).

Albumen—taste, normal; texture, hard and elastic.

Yolk—taste, normal; texture, hard and crumbly.

The following eggs were opened on September 22, 1917.

Raw:

P-4, 0-X and R-3 (July 12).

Age—about 2 months.

Shell—tending to be corroded; air cell, large, about ⅓ inch in diameter.

Outer albumen—sirupy in consistency.

Thicker albumen—shrunken; smell, normal.

Yolk—stood up well but shrunken; smell, normal.

Fried:

Albumen—taste, very slightly salty; texture, slightly hard and elastic.

Yolk—taste, normal; texture, soft.

Boiled:

0-1 and 0-4 (July 12).

Albumen—texture, hard and elastic; taste, slightly salty.

Yolk—hard and crumbly; taste, normal.

The following eggs were tested on October 16, 1917:

Raw:

P-4, R-3 (July 14), 0-9 (July 9), P-9, 0-1 (July 10).

Age—about 3 months.

Shell—corroded; color, faded.

Outer albumen—slightly sirupy and small in quantity.

Thicker albumen—shrunken; smell, slightly rancid.

Yolk—stood up well; shrunken and smell rancid.

Fried:

Albumen—taste, slightly salty; texture, hard and elastic.

Yolk—taste, slightly salty; texture, slightly sticky.

Boiled:

0-X (July 9), 0-9, R-8 (July 10), P-10 (July 14).

Age—about 3 months.

Shell—corroded; color, pale.

Albumen—taste, salty; texture, hard and elastic.

Yolk—taste, slightly salty; texture, hard and crumbly.

The following eggs were tested on November 11, 1917:

Raw:

P-4, P-10, R-7, R-10 (July 11).

Age—4 months.

Shell—corroded; air cell, very large.

Outer albumen—sirupy; pale brown; small in quantity.

Thicker albumen—very much shrunken; smell, rancid.

Yolk—stood up firmly; solidified into a sticky and tough substance; smell, slightly rancid.

Fried:

Albumen—taste, salty; texture, hard and tough.

Yolk—took time to cook well;

taste, slightly salty and rancid; texture hard and crumbly.

Boiled:

P-8, 0-1, 0-2, 0-9 (July 11).

Age—4 months.

Shell—corroded; pale; air cell, very large.

Albumen—hard and crumbled read ily; taste, slightly salty and rancid, but not disagreeable.

The following eggs were tested on October 6, 1917:

Raw:

0-5, R-10 (April 27), 0-3 (April 28).

Age—about 5 months.

Shell—corroded; pale; air cell, very large.

Outer albumen—sirupy; small in amount; color, pale brown.

Thicker albumen—very much shrunken.

Yolk—hard and somewhat sticky; smell slightly rancid.

Fried:

Albumen—taste, salty; texture, hard and elastic.

Yolk—took time to cook well; hard and crumbly; taste, rancid and salty.

Boiled:

R-9 (April 27), P-5, 0-2 (April 28).

Age—about 5 months.

Shell—corroded; pale; air cell, very large.

Albumen—taste, salty; texture, hard and tough.

Yolk—taste, salty and rancid, like ham; texture hard and crumbly. The following eggs were tested on January 25, 1918:

Raw:

R-10 (April 26), R-2 (April 27), P-6, P-9, R-X (April 28), R-9, R-10, R-X (April 29).

Age—about 9 months.

Shell—corroded and appeared very old and moistened very much; air cell, very large.

Outer and thicker albumen could hardly flow away from the yolk; very small in quantity; color, pale brown.

Yolk—hard and sticky, tough; smell, rancid.

Fried:

Albumen—hard and friable; taste, salty.

Yolk—took long to cook well; hard and crumbly; salty and rancid.

Boiled:

P-2, P-5, P-6, P-9 (A ril 26), 0-10 (April 27), P-5, P-9, 0-10, R-3 (April 28).

Shell—corroded and very moist; contents less than ½.

Albumen—adhered firmly to the shell; hard and very tough; salty and rancid.

Yolk—in all cases dark brown; oily, hard, and crumbly.

RICE BRAN

Newly prepared rice bran may be obtained from rice mills. No preparation was made except to dry the bran in the sun and then cool it before using. Forty-nine eggs were preserved by this method between April 29 and July 9, 1917, and the containing receptacle was kept in a cool room at the temperature of from 25°C to 29°C.

On August 3, 1917, the following eggs were opened for examination:

Raw:

P-3, R-2 (July 3).

Age—1 month.

Shell—normal; air cell, very small.

Outer albumen—normal.

Thicker albumen—very slightly shrunken; smell, normal.

Yolk—stood up well; very slightly shrunken.

Fried:

Albumen—taste, normal; texture soft.

Yolk—taste, normal; texture, soft.

Boiled:

P-6 (July 3); air cell, very small.

Albumen—taste, normal; texture, hard and elastic.

Yolk—taste, normal; texture, hard and crumbly.

On June 27, 1917, the following eggs were opened for examination:

Raw:

P-6, 0-10 (April 29).

Age—about 2 months.

Shell—normal; air cell, small.

Outer albumen—normal.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well; slightly shrunken; smell, normal.

Fried:

Albumen—taste, very slightly branny; texture, soft and elastic.

Yolk—taste, normal; texture, soft.

Boiled:

0-3, 0-X (April 29).

Shell—normal; air cell, small.

Albumen—taste, very slightly branny; texture, hard and elastic.

Yolk—taste, very slightly branny; texture, hard and spongy.

On August 4, 1917, the following eggs were opened:

Raw:

P-5, 0-10, R-6 (May 2), 0-8, 0-9 (May 3).

Age—about 3 months.

Shell—tending to be pale.

Outer albumen—slightly watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well but shrunken; smell, slightly sour.

Fried:

Albumen—taste, slightly branny; soft and elastic.

Yolk—taste, slightly sour; texture soft.

Boiled:

0-8, R-3, R-10, R-9 (May 2), R-3 (May 3).

Age—about 3 months.

Shell—color, faded; air cell, small.

Albumen—taste, slightly branny; texture, soft and elastic.

Yolk—taste, slightly branny and slightly acidic; texture, hard and crumbly.

On November 8, 1917, the following eggs were tested:

Raw:

R-7, R-8, R-X (July 8).

Age—4 months.

Shell—color, faded; air cell, small.

Outer albumen—watery.

Thicker albumen—shrunken; smell, slightly sour.

Yolk—shrunken and flattened on the plate; smell, somewhat sour.

Fried:

Albumen—taste, branny; texture, soft and elastic.

Yolk—taste, slightly branny and sour; texture, soft.

Boiled:

P-10, R-10 (July 8).

Shell—color, faded; air cell, small.

Albumen—taste, branny; texture, hard and elastic.

Yolk—taste, slightly branny; texture, hard and crumbly.

On October 6, 1917, the following eggs were tested:

Raw:

P-4, P-10, R-7, R-9 (May 1).

Age—about 5 months.

Shell—color, faded; air cell, somewhat large; outer shell membrane, moldy.

Outer albumen—watery; surface slightly moldy.

Thicker albumen—shrunken; smell, somewhat sour.

Yolk—weak; smell, sour.

Fried:

Albumen—slightly bitter; texture, soft.

Yolk—branny; texture, weak.

Boiled:

P-2, P-1, R-2 (May 1).

Age—about 5 months.

Shell—color, faded; air cell, large; shell membrane, black due to mold.

Albumen—taste, bitter and branny.

Yolk—taste, branny; texture, hard and crumbly.

The following eggs were opened for examination on January 25, 1918:

Raw:

P-4, R-3 (July 9), R-5, R-8, R-10, R-6 (July 6).

Age—about 7 months.

Shell—color, faded; air cell, large; shell membrane, moldy.

Outer albumen—watery; some molds on surface; smell, slightly foul.

Thicker albumen—disintegrated.

Yolk—broken and mixed with the albumen; smell, branny and slightly foul.

Fried:

Albumen and yolk—mixed into a soft, pale yellow curd; taste, slightly bitter and branny; soft and sticky in texture.

Boiled:

P-9, 0-1 (July 9), P-9, R-7 (July 7), P-3, 0-10 (May 24).

Age—about 7 months, except P-3 and 0-10 (May 24) which were about 8 months.

Albumen—pale yellow; taste, bitter and branny; texture, soft, sticky curd.

Yolk—mixed with the albumen; taste bitter and branny; smell slightly foul.

FIVE PER CENT WATER GLASS SOLUTION

To each 800 cc. of pure water previously boiled and cooled 200 cc. of a 25% water glass solution was added to make a liter of 5% solution. The cost is 26 centavos.[1] Three dozen eggs may be preserved in one liter.

The mixture was placed in a cylindrical glass receptacle and then stirred thoroughly. Between April 7 and October 31, 1917, 65 eggs were placed in the solution as they were gathered fresh from the nests. The containing vessel was covered to avoid evaporation and kept in the room at a temperature of from 25°C to 29°C.

On January 25, 1918, the following eggs were opened for examination:

Raw:

R-X (October 29), P-3, R-7 (October 31).

Age—about 3 months.

Shell—appeared very clean and new; air cell, small.

Outer albumen—slightly watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well; slightly shrunken; smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal; texture, soft.

Boiled:

R-7 (October 28), R-7 (October 29).

Age—about 3 months.

Shell—looked as nice as newly laid egg.

Albumen—taste, normal; texture, hard and tough.

Yolk—taste, normal; texture, hard and crumbly.

On August 3, 1917, the following eggs were tested:

Raw:

R-1 (April 8).

Age—about 4 months.

Shell—appeared fresh.

Outer albumen—tending to be watery but hardly different from fresh one.

Thicker albumen—slightly shrunken; smell, normal.

Yolk — stood up well; slightly shrunken; smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal; texture, soft.

1 The price has risen due to the war; normally the cost would be about 15 centavos per liter of 5% solution.

Boiled:

R-2 (April 8).

Albumen—taste normal; texture hard and elastic.

Yolk—taste, normal; texture hard and spongy.

On August 25, eggs P-5, P-X, 0-2 and R-10 were opened for a 4-month test. The results were as follows:

Raw:

P-X, 0-2.

The appearance of the shell, the quantity as well as the taste of the albumen and yolk hardly differed from those tested on August 3.

On September 22, the following eggs were opened:

Raw:

P-3, 0-2, R-5 (April 21).

Age—about 5 months.

Shell—smooth and fine; air cell, small.

Outer albumen—watery.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—stood up well, except 0-2, which was broken and mixed with the albumen; smell, normal.

Fried:

Albumen—taste, normal, texture soft.

Yolk:—taste, slightly acid; texture, soft.

Boiled:

Age—5 months.

Shell—looked clean; air cell, small.

Albumen—some foreign taste noticed; texture, slightly soft curd.

Yolk—taste, slightly strong; texture, rather soft and very slightly sticky.

On October 16, the following eggs were tested:

Raw:

0-4, R-7 (April 16).

Age—6 months.

Shell—some white deposits adhered to the surface; easily removed by washing with water; they then appeared as nice as newly laid egg; air cell, small.

Outer albumen—watery.

Thicker albumen—slightly disintegrated.

Yolk — vitelline membrane, very weak; smell, normal.

Fried:

Yolk, weak; taste, slightly acid.

Boiled:

R-4 (April 16), P-1, R-5 (April 17).

Shell—as in fresh ones.

Albumen—rather soft curd; taste, slightly acid.

Yolk—soft and sticky; taste, slightly strong or acid.

On November 16, the following eggs were used for a 7-month test:

Raw:

0-2 (April 10), P-7 (April 13).

Shell—appeared very clean; air cell, small.

Outer albumen—watery.

Thicker albumen—disintegrated, smell, sour.

Yolk—stood well, but flattened; smell, slightly sour.

Fried:

Albumen—slightly acid; texture, soft.

Yolk—P-7 was broken during frying; taste, slightly acid.

Boiled:

P-7 (April 12), 0-2 (April 13), 0-5 (April 20).

Shell—appeared good; air cell, small.

Albumen—taste, slightly acid; texture, soft curd.

Yolk—taste, slightly acid; texture, rather soft and somewhat sticky.

On December 7, 1917, 3 eggs were opened raw and shown in the College Exposition. The results were as follows:

Raw:

P-1, R-1 (April 13), 0-4 (April 14)

Age—7 months and 24 days.

Shell—looked very clean; air cell, small.

Outer albumen—watery.

Thicker albumen—watery; esmll, slightly sour.

Yolk—slightly flattened, but stood up well; smell, slightly sour.

On December 19, 21 eggs were tested. The results were as follows:

Raw:

0-2, R-1, R-4 (April 15), P-3, P-4, R-8 (April 18), P-3, R-4, R-5 (April 19), R-10 (April 23).

Age—about 8 months.

Shell—appearance attractive, and in all cases looked clean; air cell, small.

Outer albumen—watery.

Thicker albumen—watery; smell, slightly sour.

Yolk—0-2 (April 15), R-4, R-8 (April 18) had weak vitelline membrane and, after being dropped on the plate, slightly flowed to the albumen; smell, rather sour.

Fried:

P-3 and R-5 (April 19) had yolks broken during frying. The rest had the appearance of fresh eggs.

Albumen and yolk—slightly sour.

Boiled:

R-7 (April 13), P-8, R-7 (April 14), P-1, P-7, R-5 (April 15), 0-3, R-8 (April 20), P-6, R-5 (April 23), 0-X (April 24).

Albumen—a soft curd; taste, slightly acid.

Yolk—soft and slightly sticky; taste, acid.

On February 20, 1918, the following eggs were tested:

Raw:

0-9 (April 7), P-4, 0-9 (April 9), 0-3, R-2 (April 26).

Age—about 10 months.

Shell—there was a white deposit on the surface which was easily removed by washing with water. Air cell, small.

Outer albumen—watery.

Thicker albumen—watery; smell, sour.

Yolk—Only 0-3 stood up well; the rest were broken when dropped on the plate. Smell, sour.

Fried:

Taste, slightly sour, but not disagreeable. 0-3 also was broken during frying.

Boiled:

P-8, R-1 (April 10), P-4, R-7 (April 11), P-8, 0-2 (April 12).

Shell—R-1, P-4, and R-7 cracked during boiling though punctured with a needle at the bigger end. Air cell, small.

Albumen—a rather soft curd; taste, slightly acid.

Yolk—soft and sticky; taste, slightly acid.

TEN PER CENT WATER GLASS SOLUTION

To make 1 liter of 10% water glass solution, 400 cc. of 25% water glass were added to 600 cc. of pure water which had been previously boiled and cooled. The mixture was poured into an earthenware jar and then stirred thoroughly. From time to time, between May 4 and October 30, 1917, 77 newly laid eggs were preserved by this method. The containing receptacle was kept covered and placed in a cooled room.

Eggs P-5, 0-10 (May 4) and P-4, P-6 (October 25), P-6 (October 29), P-6, P-8 (October), respectively, were opened for a 3-month test on August 3, 1917, and January 24, 1918. The results were as follows:

Raw:

0-10, P-6 (October 29), P-6, P-8 (October 30).

Shell—apparently clean, smooth after washing with water; air cell, small.

Outer albumen—normal; smell, normal.

Thicker albumen—normal; smell, normal.

Yolk—stood up well; smell, normal.

Fried:

Albumen—taste, normal; texture, normal.

Yolk—taste, normal; texture, normal.

Boiled:

P-5 (May 4), P-4, P-6 (October 25).

Shell— smooth.

Albumen—taste, normal; texture, normal.

Yolk—taste, normal; texture, normal.

The following eggs were examined for a 4-month test on September 22, 1917:

Raw:

P-3, 0-X (May 22).

Shell—There were a very few white deposits which, when washed with water, disappeared entirely. Air cell, small.

Outer albumen—tending to be watery; smell, normal.

Thicker albumen—slightly shrunken.

Yolk—stood up well, but slightly shrunken; smell, normal.

Fried:

Albumen—taste, normal; texture, soft-elastic.

Yolk—taste, normal; texture, normal.

Boiled:

P-6 (May 22), R-7 (May 23).

Shell—looked as clean as newly laid eggs; air cell, small.

Albumen—taste, normal; texture, hard, elastic.

Yolk—taste, normal; texture, soft.

On October 16, 1917, 6 eggs were used for examination. The results were as follows:

Raw:

P-8, R-4, R-5 (May 14).

Age—about 5 months.

Shell—A few white deposits could be seen; easily taken off by washing with water. Air cell, small.

Outer albumen—watery.

Thicker albumen—slightly disintegrated; smell, normal.

Yolk—stood up well, but was slightly shrunken; smell, normal.

Fried:

Albumen—taste normal; texture, soft.

Yolk—taste, normal; texture, soft.

Boiled:

P-10 (May 14), R-4, R-5 (May 16).

Age—5 months.

Shell—R-5 cracked in spite of being previously punctured; air cell, small.

Albumen—taste and texture, normal.

The following eggs were examined for a 6-month test on November 6, 1917. The results were as follows:

Raw:

P-5, P-8, 0-9 (May 7).

Shell—all nice and very clean after washing off the white deposits with water; air cell, small.

Outer albumen—watery.

Thicker albumen—watery; smell, normal.

Yolk—P-8 broken; the rest stood up well, but flattened a little on the plate; smell, normal.

Fried:

Albumen—taste, normal; texture, soft, elastic.

Yolk—taste, normal; texture, soft.

Boiled:

P-10 (May 10), 0-4 (May 11), P-4, P-X, 0-8 (May 12), 0-5, R-4 (May 13),

Albumen—taste, slightly sour; texture, soft curd.

Yolk—taste, slightly sour and rancid; texture, rather soft and very slightly sticky.

Eggs P-8, P-9, P-10, 0-6, R-7, 0-9 (May 4), P-1, P-4, 0-8, R-1, R-9, P-1, P-4, 0-4, 0-8, R-1, R-6, R-8 (May 7), P-3, P-8, P-10, 0-6, 0-8, 0-9, R-7 (May 8), P-4, 0-1, 0-4, R-8 (May 9), P-4, P-8,

0-9, R-1 (May 10) were examined for a nine-month test on February 17, 1918:

Raw:

Eighteen eggs used.

Shell—looked very clean and hardly differed in appearance from newly-laid eggs; air cells, small.

Outer albumen—watery; smell, slightly sour.

Thicker albumen—watery.

Yolk—7 broken, while the rest flattened; R-8 had a pale yellow color; smell, slightly sour in all cases.

Fried:

Albumen and yolk of broken eggs—mixed together, forming a pale yellow soft curd; slightly sour and very slightly rancid.

Yolk—The yolks that were not broken had a soft texture and a slightly sour and rancid taste.

Boiled:

Fifteen eggs used.

Shell—5 cracked during boiling, though previously punctured with a needle at the bigger end. Air cell, small.

Albumen—taste, slightly sour; texture, soft curd.

Yolk—taste, slightly sour and rancid, but not disagreeable; texture, rather sticky.

SALT AND SAND MIXTURE

This mixture was prepared by mixing 500 grams of common salt (NaCl) with 9 kilograms of pure clean sand in dry condition and then stirred throughly until all particles of the former were distributed uniformly among the latter. The mixture was placed in a tin receptacle and 1.5 liters of pure water previously boiled and cooled was added to render the mass more compact. Thirteen eggs were packed by this method between August 7 and 19, 1917. There were about 10 centimeters of the mixture above the upper layer of the eggs. The containing can was kept covered in a cool place.

On September 22, 1917, four eggs were examined for a one-month test. The results were as follows:

Raw:

P-6 (August 16), P-6 (August 18).

Shell—corroded; air cell, small.

Outer albumen—watery.

Thicker albumen—shrunken.

Yolk—greatly shrunken, harder, but stood up round; smell, fresh.

Fried:

Albumen—salty, soft and elastic.

Yolk—It took time to cook it; tough and hard.

Boiled:

P-6, P-X (August 19).

Albumen—salty, soft curd.

Yolk—slightly salty; tough and spongy.

On October 16, the following eggs were opened for a two-month test:

Raw:

P-10 (August 15).

Shell—corroded; air cell, small.

Outer albumen—watery.

Thicker albumen—shrunken.

Yolk—shrunken a great deal more than that of the 1-month egg; sticky and hard; smell, fresh.

Fried:

Albumen—extremely salty; texture, rather hard and brittle.

Yolk—taste, salty; texture, hard and crumbly. It took long to be well cooked.

Boiled:

0-9 (August 15).

Albumen—taste, extremely salty; texture, rather soft curd.

Yolk—taste, salty; texture, hard and spongy.

On October 17, two eggs were soaked in water at different lengths of time—one for 2 hours and the other for 6 hours. The amount of water used was 500 cc.

in each case. The results were as follows:

Boiled:

P-6 (August 12), immersed for 2 hours.

Albumen—remained very salty; texture, soft curd.

Yolk—remained salty; texture, hard and crumbly.

Boiled:

P-10 (August 12) immersed for 6 hours.

Albumen—less salty than above; texture, soft curd.

Yolk—salty; texture, hard and crumbly.

On November 10, five eggs were opened for examination. One was opened raw; one after boiling without previously soaking in water; and 3 were previously soaked in water at different intervals of time, so as to get rid of most of the salt and then boiled. The results were as follows:

Raw:

P-9 (August 9).

Age—about 3 months.

Shell—corroded; air cell, rather large.

Outer albumen—watery.

Thicker albumen—shrunken.

Yolk—stood up round; texture hard, sticky and tough. It could not be fried as usual.

Boiled:

0-9 (August 13).

Shell—corroded.

Albumen—extremely salty; texture soft curd; smell, slightly rancid.

Yolk—salty; texture, rather hard and spongy; smell, slightly rancid.

Boiled:

P-6 (August 14), after 12 hours' immersion.

Albumen—not so salty as after 6 hours' soaking; texture, soft curd.

Yolk—remained salty; texture, hard and crumbly.

Boiled:

R-2 (August 7), after 24 hours' immersion.

Albumen—salty and soft curd.

Yolk—salty; texture, hard and crumbly.

Boiled;

P-9 August 14), after 30 hours.

Albumen—salty as the colored eggs usually sold at the market; perfectly soft curd.

Yolk—slightly salty and slightly rancid; texture, hard and spongy.

TEN PER CENT SALT SOLUTION

From time to time between August 21 and September 3, 1917, twenty-three newly-laid eggs were preserved in this solution. It was prepared by dissolving 200 grams of common salt (Nacl) in 2 liters of pure water, previously boiled and cooled. The mixture was stirred as much as possible until the salt was completely dissolved. It was filtered through a piece of white cheesecloth in a glass vessel. The containing vessel was kept covered, in a cool room.

On September 22, 1917, three eggs were opened for a one-month test. The results were as follows:

Raw:

P-2 (August 22).

Shell—corroded; color, faded; air cell, small.

Outer albumen—watery.

Thicker albumen—shrunken; disintegrated; smell, slightly rancid.

Yolk—stood up solid; greatly shrunken and slightly hardened.

Fried:

Albumen—salty; soft in texture.

Yolk—taste, salty but agreeable; texture, rather hard and sticky; smell, very slightly rancid.

Boiled:

R-X (August 22), P-4 (August 23).

Albumen—taste, salty, as the colored eggs usually sold at the market; texture, soft curd.

Yolk—taste, slightly rancid and salty; texture, hard and crumbly.

On October 16, all eggs preserved in this solution were examined. One-half of them were opened and the rest were boiled. By this time the solution was becoming cloudy due to some mold forming on top of the water. Also, the solution, as well as the eggs, gave off a bad smell.

Raw:

P-1, P-2, R-7 (August 27), P-4 R-1 (August 28), R-7 (August 29), R-1, R-7 (August 30), 0-X, R-1 (September 1), P-1 (September 6).

Age—1 month and 10 days to 1 month and 19 days.

Shell—corroded and faded; air cell, small.

Outer albumen—watery.

Thicker albumen—watery in some cases and slightly disintegrated in others; gave off bad smell.

Yolk—hard, sticky, and stood up firmly; smell, slightly disagreeable.

Fried:

Albumen—made the lard spatter due to its watery condition; very salty in taste, but soft in texture.

Yolk—took time to be well cooked; became dark brown; hard and spongy; salty and rancid. All had slightly bad smell.

Boiled:

R-X (August 24), P-4, R-7 (August 26), P-4 (August 31), P-4, 0-X (September 2), 0-X R-1, R-X (September 3).

Albumen—soft curd; very salty; smell, slightly bad.

Yolk—hard and spongy; salty and rancid. The vitelline membrane was dark brown in most cases, but the interior portion was either pale yellow color or reddish brown.

WATER COOLING

A glass jar was immersed in water to about 1 inch below the mouth. Between September 5 and 18, 1917, twenty-three eggs were placed in this jar which was kept covered.

On October 16, 1917, the following eggs were examined for a one-month test.

Raw:

R-6 (September 17).

Shell—normal; air cell, normal.

Outer albumen—normal

Thicker albumen—slightly shrunken.

Yolk—stood up round; very slightly shrunken.

Fried:

Albumen—taste, normal; texture, normal.

Yolk—taste, normal; texture, normal.

Boiled:

P-5 (September 17).

Shell—normal; air cell, normal.

Albumen—taste, normal; texture, soft and elastic.

Yolk—taste, normal; texture, hard and crumbly.

On November 6, the following eggs were opened for a two-month test:

Raw:

R-6, P-3 (September 8), P-1 (September 8).

Shell—hardly differed from fresh egg; air cell, small.

Outer albumen—normal.

Thicker albumen—slightly shrunken; smell, fresh.

Yolk—stood up well, but slightly shrunken; smell, normal.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal, texture, soft.

Boiled:

P-1, 0-10 (September 11).

Albumen—taste, normal; texture, rather tough and elastic.

Yolk—taste, normal; texture, hard, crumbly; smell, normal.

On December 7, the following eggs were opened for the College Exposition:

Raw:

P-3, P-10, 0-10 (September 12).

Age—about 3 months.

Shell—slightly faded but fresh looking; shaken loose; air—cell, larger than fresh egg.

Outer albumen—Some molds grew on the outer shell membrane, but not mixed with albumen; smell, slightly foul.

Thicker albumen—slightly disintegrated.

Yolk—P-10 and 0-10 had broken vitelline membranes; foul smelling.

On December 19, 1917, six eggs were opened raw:

Raw:

P-3, R-6 (September 14), P-5 (September 15).

Age—about 3 months.

Shell—fresh looking; air cell, larger than fresh eggs.

Outer albumen—some black molds floating about the shell membrane.

Thicker albumen—shrunken and slightly disintegrated; smell, slightly foul.

Yolk—All had broken vitelline membrane and flowed to the albumen; smell, slightly foul.

Fried:

Albumen and yolk—mixed together; turned pale yellow; curd, soft; taste, slightly bitter and unpleasant.

Boiled:

P-10 (September 13), P-10 (September 16), R-10 (September 18).

Albumen—slightly bitter and rancid; rather elastic; light gray.

Yolk—hard and crumbly; taste, slightly bitter; smell, slightly like foul dry meat.

DRY LIME (CaO)

Between September 19 and 26, 1917, seventeen eggs were packed in lime. About two inches of the lime were on the upper layer of eggs. The containing can was covered and kept in a cool room.

On December 7, 1917, three eggs were opened for the College Exposition. The results were as follows:

Raw:

P-10, 0-8 (September 19), P-5 (September 20).

Age—2 months and 17 days.

Shell—no difference from newly-laid eggs; air cell, larger than fresh egg.

Outer albumen—very slightly sirupy.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—slightly shrunken; smell, fresh; stood up round.

On January 10, 1918, the following eggs were opened for examination:

Raw:

P-5, 0-8, R-5 (September 22).

Age—about 3 months.

Shell—hardly different from newly laid eggs; air cell, rather large.

Outer albumen—slightly sirupy.

Thicker albumen slightly shrunken, smell, normal.

Yolk—stood up round; slightly shrunken and wrinkled; smell, normal.

Fried:

Albumen—taste, very slightly rancid; texture, rather soft, elastic.

Yolk—taste, very slightly rancid; texture soft, like the normal.

Boiled:

0-8 (September 24), 0-8 (September 26), 0-9 (September 25).

Albumen—hard and elastic; taste, very slightly rancid, but agreeable.

Yolk—hard and crumbly; taste, very slightly rancid.

On January 22, 1918, all eggs preserved were opened for examination. The results were as follows:

Raw:

R-10 (September 23), P-5, P-10 (September 25), R-10 (September 26).

Age—about 4 months.

Shell—looked very nice; no difference from newly laid eggs; air cell, rather large.

Outer albumen—sirupy and partly evaporated.

Thicker albumen—shrunken; smell, slightly rancid and slightly sour.

Yolk—All had weak vitelline membrane, broken as soon as they were dropped on the plates, and flowed a little to the albumen.

Fried:

Albumen—formed a soft pale yellow curd, due to the broken yolk; taste, rancid.

Yolk—taste, rancid, but agreeable.

Boiled: 0-8 (September 21), P-10 (September 22), 0-10 (September 24), R-5 (September 26).

Albumen—taste, rancid; P-10, rancid and sour; taste, very unpleasant, texture, rather soft and elastic; smell, rancid.

Yolk—hard and crumbly; taste, rancid.

CONTROL

There were 30 eggs used as control. They were placed in exposed boxes and set on rice hulls, and the boxes were kept in a cool room.

On March 30, eight eggs were opened for a one-month test. The results were as follows:

Raw: 0-1 (March 7), R-X, R-2 (July 4), P-1 (November 6), P-8, R-5 (November 7). [1]

Shell—hardly different from eggs two or three days old; air cell, rather large.

Outer albumen—tended to be sirupy.

Thicker albumen—slightly shrunken; smell, normal.

Yolk—slightly shrunken; smell, normal; stood up solid.

Fried:

Albumen—taste, normal; texture, soft.

Yolk—taste, normal; texture, normal.

Boiled:

R-3 (March 7), 0-10 (July 4).

Shell—fresh looking; air cell, rather large.

Albumen—taste, normal; texture, slightly tough and elastic.

Yolk—taste, normal; texture, hard and crumbly.

On May 12, 1917, P-9, 0-4, R-4 (March 8) were opened for a two-month test. The results were as follows:

Raw:

0-4 produced sound when shaken.

Shell—color, slightly faded; air cell, large.

Outer albumen—small in amount; sirupy.

Thicker albumen—shrunken; smell, slightly rancid.

Yolk—flattened, but stood up well; smell, slightly rancid.

Fried:

Albumen—easily cooked; taste, slightly rancid; texture, rather hard and brittle.

Yolk—taste, slightly rancid but agreeable; texture, soft and slightly sticky.

Boiled:

P-9, R-4.

Albumen—texture, tough and elastic; taste, slightly rancid.

Yolk—texture, hard and crumbly; taste, slightly rancid; color, pale yellow.

[1] These eggs were not included in the record of preservation, because the recording of eggs preserved was closed on October 31, 1917.

On June 15 the following eggs were used for a three-month test. The results were as follows:

Raw:

P-5 (March 7) produced sound when shaken.

Shell—color, faded; air cell, about ⅓ inch in diameter.

Outer albumen—sirupy; about ½ the normal amount; color, very light brown; smell, rancid.

Thicker albumen—greatly shrunken.

Yolk—tended to be hard; sticky; smell, rancid.

Fried:

Albumen—rather hard and brittle; taste, rancid and disagreeable.

Yolk—soft and sticky; taste, rancid; color, reddish brown.

Boiled:

R-7 (March 7).

Albumen—tough and elastic; taste, rancid.

Yolk—hard and spongy; taste, rancid and disagreeable.

On November 6, four eggs were examined. The results were as follows:

Raw:

P-8 (July 21), P-8 (July 23).

Age—about 3½ months.

Shell—color, faded; air cell, ⅓ the inner volume of the egg.

Outer albumen—sirupy; very small; smell, rancid.

Thicker albumen—P-8 (July 23) disintegrated as well as the yolk and the latter ran to the albumen; smell, slightly foul.

Yolk—P-8 (July 21) hardened slightly and stood up firmly; smell, rancid.

Fried:

P-8 (July 21).

Albumen—very easily cooked; hard and brittle, taste, rancid.

Yolk—taste, rancid; texture, rather hard and spongy.

Boiled:

P-4 (July 17), P-10 (July 19).

Albumen—tough and elastic; taste, rancid.

Yolk—hard and crumbly; taste, rancid and unpleasant.

On January 25, 1918, six eggs were opened for a four-month test. The results were as follows:

Raw:

0-9 (September 28), 0-10, R-10 (September 30).

Shell—color faded greatly; shiny and smooth; contents, almost ½ the original. Produced sound when shaken.

Outer albumen—very little; very much condensed.

Thicker albumen—very much condensed; color, light brown.

Yolk—greatly shrunken; cohesive, tough, hard and sticky.

Fried:

Albumen—easily cooked; taste, rancid; texture, hard and brittle.

Yolk—took a long time to be well cooked; taste, rancid; hard and spongy, very small in quantity.

Boiled:

0-10, R-10 (September 28), 0-9 (September 30).

Albumen—adhered firmly to the shell; taste, rancid; hard and very tough.

Yolk—hard and crumbly; taste, rancid.

SUMMARY

During the period between October 1 and 31, 1917, 712 newly-laid eggs were preserved in thirteen different kinds of preservatives:—(1) dilute cane molasses; (2) concentrated molasses; (3) 5% common salt solution; (4) limewater; (5) vaseline; (6) 5% water-glass solution; (7) 10% water-glass solution; (8) rice bran; (9) dry coarse common salt; (10) salt-and-sand mixture, (11) 10% common

salt solution; (12) water cooling; (13) dry lime; and (14) control.

1. *Dilute cane molasses.* This solution as an egg preservative was very impractical, for after five days the mixture fermented and became sour. The mineral matter of the shell was more or less dissolved by the acid which resulted from fermentation and the egg contents became sour and were thus rendered unfit for human food.

2. *Concentrated cane molasses.* As an egg preservative, cane molasses preserved eggs for three months without changing the nature of the egg contents. The contents appeared fresh. At six months, the albumen shrunk a great deal; and by this time it being almost dry could hardly flow away from the yolk. The yolk was hard, tough and rather sticky. It smelled sweet, like molasses, and the taste was similar to that of green corn.

3. *5% common salt solution.* This solution proved to be satisfactory for two months' preservation, if salted eggs are desired. The albumen and yolk were normal otherwise.

4. *Limewater.* Eggs preserved in lime water had always their air cells small throughout eight months, preservation. The shell was nice and clean looking. At the end of two months, slightly chalky taste was noticed in the albumen. At the third month the albumen was slightly watery and at the fifth month it was conspicuously watery. At the seventh and eighth months some eggs were found to have broken yolks which flowed into the albumen. Eggs in this condition could not be regarded as rotten because the smell and taste was as good as the others with whole yolk. The albumen had a slight chalky taste and the yolk tasted slightly sour.

5. *Vaseline.* Eggs varnished with plain cosmoline had their air cells small, and the contents tasted like olive oil or vaseline or wax, but not disagreeable, even after seven months. The shell looked oily and dirty. At the fourth monthy the albumen was found to be water and the yolk was lightly shrunken. Between the sixth and the eighth month some eggs had broken yolks, and these flowed to the albumen a little. Such broken yolks could not be considered as spoiled for they had the smell and taste of good eggs.

6. *5% water glass solution.* The shell of eggs preserved in water glass appeared clean and fresh looking during ten months' preservation. The air cell remained small. At the end of four months, the eggs were hardly different from newly laid eggs. At the fifth month the albumen was watery. Between this time and the eighth month some eggs had weak vitelline membranes. At the sixth month white deposits were observed on the shell, which could easily be removed when washed with water. From the fifth to the tenth month the contents of the egg tended to be slightly acid in taste, but could hardly be distinguished in appearance from either raw or cooked fresh eggs.

7. *10% water glass solution.* In effectiveness, this solution was similar to 5% water glass. The noticeable difference was that the 10% solution begun to deposit white crusts in the shell at the fourth month.

8. *Rice bran.* Eggs packed in rice bran had their air cells normal between the first and the fourth month; between the second and third month the egg contents were branny in taste; and were excessively so between the third and the fourth month. Between the fourth and fifth the albumen and yolk assumed a bitter taste; between the fifth and the seventh month the outer shell membrane was partly moldy; molds floated in the albumen; the yolk disintegrated and mixed with the albumen; the whole

contents smelled foul. Eggs in this condition were unfit for human food.

9. *Dry coarse common salt.* Packing eggs in dry common salt was found satisfactory for one or two months' preservation. By this time the air cell was about $\frac{1}{3}$ inch in diameter; the albumen inclined to be sirupy in consistency and the yolk had the tendency of being hard, tough and sticky, either raw or cooked. Between the second and the fourth months the contents were greatly evaporated, the air cell occupying $\frac{1}{3}$ of the egg. Between the fourth and the fifth months nearly all the albumen contents had evaporated and the yolk became tough and sticky and raw and crumbly when cooked. In general at two months the egg contents assumed a salty and slightly rancid taste which was not at all disagreeable.

10. *Salt-and-sand mixture.* Eggs preserved in salt-and-sand mixture in wet condition (500 grams of coarse common salt to 9 kilograms of pure sand) were extremely salty in taste after one month's preservation. The albumen and yolk were normal in amount between the first and the third month. Soaking the preserved eggs in water for at least thirty hours, reduced the extreme salty taste. After one month in this preservative the yolk begun to be tough and sticky while raw. For this reason, it is not advisable to fry the eggs; they should be boiled.

11. *Ten per cent common salt.* After one month in the preservative, the albumen became watery and slightly disintegrated; the yolk became rather hard, tough and sticky. The contents were salty and very mildly rancid. Eggs in this condition may be compared to the artificially red-colored salted eggs sold at the market. After two months' preservation the solution became cloudy due to molds forming on the surface of the water. The solution, as well as the eggs, gave off a bad smell.

12. *Water cooling.* With water cooling fresh eggs may effectively be preserved for a period of two months. The egg contents could hardly be distinguished in appearance, flavor, smell and texture, from either raw or cooked fresh eggs. At the third month, their outer shell membranes were moldy. In this stage, the contents could be shaken. The yolk had weak vitelline membranes and mixed with the albumen. All eggs in this condition gave off a foul smell, thus making the eggs unfit for human food.

13. *Dry lime.* Eggs preserved in dry lime kept good for two or three months; the yolk was very much shrunken and the vitalline membrane was wrinkled. All eggs examined for the four-month test had broken, wrinkled vitelline membranes so the yolk ran a little to the albumen. Egg contents either boiled or fried, could be eaten for they had an agreeable, slight rancid taste.

14. *Control.* Eggs kept as control were all good at the end of the first month. Between the second and the third month the egg contents begun to deteriorate and by this time the air cell became noticeably large. The shell was faded. The albumen was small in amount and had a sirupy consistency and rancid smell. The yolk was inclined to be hard, tough and sticky. Eggs in this condition acquired a disagreeable rancid taste.

RECOMMENDATIONS

Limewater as an egg preservative is to be preferred to the other substances employed in the present experiments for the following reasons: (1) It is inexpensive; (2) readily obtainable, and is (3) capable of preserving eggs for as long a period as eight months. The

eggs preserved for four or five months in limewater could hardly be distinguished in quality and quantity of contents either when raw or after cooking from fairly fesh eggs. However, the egg contents may acquire a slighly chalky taste.

Water glass to the strength varying from 5% to 10% may prove effective. A 5% water glass solution is to be preferred inasmuch as it gives almost as good results as the 10% solution, and is prepared much more cheaply. A liter of this solution costs approximately thirteen centavos. Eggs preserved for six months in the 10% solution had no acid taste while those in the 5% solution were noticed to be acid after five months.

Vaseline as a preservative for eggs proved as effective as both limewater and water glass. It is not very practical for the following reasons: (1) It is rather expensive. (2) Varnishing each egg with vaseline with the fingers takes time. (3) It is oily and readily collects dirit, making the shell appear old. (4) Even at the first month it imparts to the eggs an oily taste, which is not agreeable. Otherwise, it preserves eggs for a period of eight months.

For two or three months' preservation, fresh cane molasses, dry coarse common salt, rice bran and dry lime may be recommended.

Soaking the eggs in 5 and 10% common salt solution and packing the eggs in the salt-and-sand mixture for one or two months will prove satisfactory for making salty eggs. Eggs preserved in salt-and-sand mixture should be soaked in fresh water for about 24 hours before cooking; otherwise, the egg contents will be extremely salty. In all cases the preserved eggs tested were boiled for 10 minutes.

SUGGESTIONS

The following suggestions for any one interested in the preservation of eggs are given by Arthur: [1]

1. The eggs should not be washed before packing, for washing injures the keeping quality, probably by dissolving the mucilaginous coating.

2. Before boiling eggs which have been preserved in limewater and water glass, the shell should be punctured with a needle, otherwise it is liable to crack.

By Lamson: [3]

3. Keep the whole flock in as near a perfect state of health as possible.

4. Give enough shell-forming food to the hens so that the shells will be strong and uniform in thickness.

5. Make proper nesting places and keep them clean, so that the eggs may not be infected while in the nests.

6. Gather the eggs every day.

7. Keep the gathered eggs in a dry, cool room where the sun's rays do not fall directly upon them.

8. Use only the clean eggs and place them in the preservative within 24 hours after the time they are laid.

By Bowman: [4]

"The eggs should be placed in the receptacle being sure that none are dirty or cracked and over them the liquid should be poured until all are completely submerged. They should be kept submerged about an inch below the top of the liquid. The receptacle should be covered to prevent evaporation; if left exposed, the mixture turns a milky white and does not preserve the eggs properly. The preserving solution should not be used for more than one batch of eggs or more tha none season."

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1 U. S. Dept. of Agr. Farmers' Bull. No. 287: 41-42, 1917.

3 Agricultural Experiment Station (Scorts) Bull. No. 67: 272-273. 1911.

4 Lewis, Productive Poultry Husbandry: p. 442. 1914

EXPERIMENT II

SOME OBSERVATIONS ON THE BEHAVIOR OF CHICKENS IN PENS WITH AND WITHOUT MALES WITH REGARD TO FEEDING, EGG PRODUCTION, ETC.

This experiment was undertaken in cidental to the first one so as to furnish eggs from day to day for the experiments on preservation. The period covered is from March 1, 1917 to February 28, 1918.

Plan of Experiment

Arrangement.—On March 1, 1917, three pens numbered as Pen-P, Pen-O, and Pen-R, were stocked with ten pullets, ten pullets and one rooster and ten pullets and two roosters, respectively. Each pen was equipped with two trap nests which enabled the writer to keep individual egg records.

Description of chickens and pens.—The pullets and roosters were bought in the barrio of San Antonio, Los Baños, and in the town of Bigaa, Bulacan. Of the thirty pullets used in this experiment six only came from the latter place. All pullets were of as nearly the same age as could be obtained. They had started laying when purchased. The roosters used were young, except the one owned by the College which was about three years old. It was placed in Pen-R. The pullets were numbered 1 to 10 in each pen.

The houses used were of the gable-roof type,made of bamboo and nipa,and rather open in construction, for the purpose of ventilation. The walls were two meters high and made of woven bamboo. The floor space was 2 by 3 meters. The yards, enclosed with chicken wire surrounding each house were 12.5 by 17 meters. These yards were kept in grass and the fowls had access to them at all times.

Care and Feeding.—All birds received similar treatment, care and food. Each pen was supplied with hoppers containing dry mash, charcoal, cracked oyster-shell; a bamboo water-trough was also supplied. A box for storing the grain feed was kept in the house. The grain ration was given every day in the morning and afternoon. At about 9:30 a. m. animal feed in the form of snails whenever available was also given. The chickens had free access to the dry mash rations, charcoal, cracked oyster-shell, grass and fresh water all the time.

The grain ration consisted of a mixture of equal parts of corn and unhulled rice. During the period between the latter part of July and December, 1917, corn alone was given to the fowls, for their grain rations, because there was no rice available at the time. But from the earlier part of January to the end of the experiment the grain ration was given as before.

The dry-mash ration consisted of three kilograms cracked corn, three kilograms rice bran, 1.5 kilograms copra meal and 2.5 kilograms ground rice. As indicated in the grain ration, rice was not included between July and December.

The animal feed for each pen consisted of a handful of boiled cracked snails weighing about 35 grams. This was given from March 1 to November 22, 1917, a period covering about nine months. From February 1 to February 28, 1918, about 68 grams of ground bone was given daily to each lot.

Ripe papaya was also given occasionally and green grass which was growing abundantly in the yards throughout the year was always available for feed.

Sanitation.—Every morning the dropping board and the floor space of each pen were cleaned. The nests were kept clean all the time and the nesting material which was of excelsior was removed every month. Every day, in the morn-

ing, the bamboo water trough was thoroughly cleaned.

GENERAL OBSERVATIONS

Pen-P was stocked with 10 hens and no males, whereas Pen-O was stocked with 10 hens and 1 rooster; and Pen-R with 10 hens and 2 roosters. This arrangement allowed a comparison of the egg production of hens in pens with and without males.

After a few months' confinement, the fowls in Pen-O, became more contented to stay in their own pen. At times those in Pen-P desired to get into the neighboring pens which were provided with roosters; they attempted to get through the chicken wire which enclosed the pens. When petted, two or three hens in this pen would assume a crouching position as if waiting for the male to tread on them, and they expelled a liquid.

At the beginning of July the fowls began to molt. The molting period extended up to the latter part of December.

P-7 died of egg-binding on April 19, 1917. Four hens died in Pen-O. Of these four, one died apparently of liver disease, her liver having been found to be abnormal in size. The cause of the other three deaths is not known since the hens were apparently healthy.

Between August 23, 1917 and January 27, 1918, three hens and the two roosters died in Pen-R. There was no apparent cause for this mortality. Since the roosters in this pen were important, they were replaced immediately.

Broodiness occurred in all the pens. Every time a hen was broody, she was confined in a separate pen for 6 or 7 days, and fed as usual. It was noticed that a hen was fat every time she was laying eggs and inclined to be thinner toward broodiness. In other words, a hen was fat during the best laying condition and was lean during broodiness.

EGG PRODUCTION AND FOOD CONSUMPTION

Between March 1, 1917 and February 28, 1918 eggs, laid by individual hens were recorded, as well as the food consumption. The records of the eggs laid are summarized in Table II.

Table II shows the individual egg records for each month and the total number of eggs laid during the year. It is noticeable in this table that the best producer in Pen-P was P-8 this having laid forty-six eggs during one year. Others laid between fifteen and forty-two eggs without taking into account the fifteen floor eggs. The average for this pen, including the floor eggs, was 35.51.

In Pen-O the best laying hen was 0-10, this having laid fifty-five eggs during twelve months. Others laid between nineteen and thirty-three eggs, without taking into account the twenty-six floor eggs from this pen. The average for the pen was 34.92.

The best laying hen in Pen-R was R-10. She produced fifty-five eggs during the year. Others produced between twenty-three and forty-four eggs. In this pen, there were fifteen floor eggs. The average for the pen was 39.02.

Table III shows the average egg production of individual hens in pens with and without males. In this table the total possible days, "Average Number of Hens", and "Average Number of Eggs" laid by each hen are given.

By multiplying the actual number of hens in a pen at the beginning of the month by the number of days in the month, the "Total Possible Days" is obtained. In case a hen dies some time during the month, due correction is made by substracting the number of days remaining in the month after every death. By dividing the number thus found by the number of days in the month, the "Average Number of Hens"

TABLE II

INDIVIDUAL EGG RECORDS FOR THE MONTH AND FOR THE YEAR

Date	PEN-P P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Px	Total eggs laid for the month	PEN-0 01	02	03	04	05	06	07	08	09	010	0x	Total eggs laid for the month	PEN-R R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Rx	Total eggs laid for the month
March, 1917	5	2	5	2	7	8	1	5	11	7	2	55	9	6	7	8	6	4	3	10	8	10	4	75	5	10	7	12	9	5	5	3	9	11	1	77
April, 1917	3	6	4	3	5	4	3	5	6	0	2	41	0	7	5	3	2	0	6	1	3	6	2	35	4	5	7	8	5	0	4	2	2	10	5	52
May, 1917	3	1	2	6	3	5		5	3	5	2	35	1	2	0	3	4	3	0	6	7	7	1	34	3	3	2	6	5	3	7	2	4	5	0	40
June, 1917	4	0	3	6	6	3		6	5	6	2	41	5	3	8	0	10	3		7	6	1	4	47	5	1	3	3	4	3	0	5	7	2	1	34
July, 1917	0	0	3	6	0	2		7	3	4	0	25	4	1	0	1		3		0	3	6	3	21	1	2	4	0	2	0	4	3	0	4	3	23
Aug., 1917	1	2	0	4	0	6		0	2	2	1	18	0	0	0	0		1		0	2	0	0	3	2	4		0	0	0	4	0	0	0	2	12
Sept., 1917	3	0	3	2	5	0		0	0	6	0	19	0	1	0	1		0		7	3	3	5	20	2			0	2	5	0	0	0	5	2	16
Oct., 1917	3	0	1	1	0	4		6	0	0	0	15	0	0	0	0		0		1	1	0	2	4	0			0	3	0	3	0	0	0	1	7
Nov., 1917	1	0	0	4	0	2		6	2	0	4	19	0	0	0	0		0		0	0	5	0	5	4			0	6	0	2	2		5	0	19
Dec., 1917	1	0	1	0	2	3		0	2	0	0	9	0	0	0	0		0		0	0	3	1	4	1			0	0	1	0	7		2	0	11
Jan., 1918	1	1	1	4	0	1		1	1	2	2	14	0	0	0	0		0		0	0	4	2	12	4			0	0	0	8	0		3	0	15
Feb., 1918	3	3	4	5	6	4		5	3	5	0	38	3	9	9	3		0		4	0	10	2	40	7			5	8	6	4	6		7	0	43
Total No. of eggs laid by each hen for the year.	28	15	27	43	34	32	4	46	48	37	15	329	22	35	29	19	22	14	9	36	33	55	26	300	38	25	23	34	44	23	41	30	22	54	15	349

P7- died on April 19, 1917.

0-7 died on June 15, 1917.
0-5 died on July 25, 1917.
0-6 died on November 25, 1917.
0-9 died on December 16, 1917.

R-3 died on August 23, 1917.
R-2 died on September 9, 1917.
R-9 died on November 15, 1917.

TABLE III

AVERAGE EGG PRODUCTION OF INDIVIDUAL HENS IN PEN WITH AND WITHOUT MALES FOR THE MONTH

Date	PEN-P No. of Hens	No. of Roosters	Total Possible Days	Ave. No. of Hens	Total No. of Eggs	Ave. No. of Eggs per Hen	PEN-0 No. of Hens	No. of Roosters	Total Possible Days	Ave. No. of Hens	Total No. of Eggs Laid	Ave. No. of Eggs per Hen	PEN-R No. of Hens	No. of Roosters	Total Possible Days	Ave. No. of Hens	Total No. of Eggs Laid	Ave. No. of Eggs per Hen
March, 1917.....	10	0	310	10	55	5.50	10	1	341	10	75	7.50	10	2	372	10	77	7.70
April, 1917.....	10-9	0	288	9.60	40	4.166	10	1	330	10	35	3.50	10	2	360	10	52	5.20
May, 1917.....	9	0	279	9	35	3.88	10	1	341	10	34	3.40	10	2	372	10	40	4.00
June, 1917.....	9	0	270	9	41	4.55	10-9	1	314	9.46	47	4.96	10	2	360	10	34	3.40
July, 1917.....	9	0	279	9	25	2.77	9-8	1	303	8.77	21	2.28	10	2	372	10	23	2.30
Aug., 1917.....	9	0	279	9	18	2.00	8	1	279	8	3	0.37	10-9	2	363	9.70	12	1.23
Sept, 1917.....	9	0	270	9	19	2.11	8	1	270	8	20	2.50	9-8	2	308	8.26	16	1.93
Oct., 1917.....	9	0	279	9	15	1.66	8	1	279	8	4	0.50	8	2	310	8	7	0.87
Nov., 1917.....	9	0	270	9	19	2.11	8-7	1	264	7.80	5	0.64	8-7	2	284	7.46	19	2.54
Dec., 1917.....	9	0	279	9	9	1.00	7-6	1	232	6.49	4	0.61	7	2	279	7	11	1.57
Jan., 1918.....	9	0	279	9	14	1.55	6	1	217	6	12	2.00	7	2	279	7	15	2.14
Feb., 1918.....	9	0	252	9	38	4.22	6	1	196	6	40	6.66	7	2	252	7	43	6.14
Ave. No. of Eggs per Hen for the Year						35.51						34.92						39.02

P-7 died on April 19, 1917.

0-7 died on June 15, 1917.
0-5 died on July 25, 1917
0-6 died on November 25, 1917.
0-9 died on December 16, 1917.

R-3 died on August 23, 1917.
R-2 died on September 9, 1917.
R-9 died on November 15, 1917.

in the pen is obtained. By dividing the number of eggs laid in each pen, per month, by the average number of hens, the average number of eggs per hen for the month is obtained.

The table shows that the highest average egg production per month was during March, April, May, and June, 1917 and February, 1918.

One reason for hens producing more heavily during the period between March and June, 1917 and during the month of February, 1918 is probably the fact that all the hens have passed the molting period, while during the other months, there were hens molting.

Considering the egg production for the year, Pen-R produced the greatest number of eggs; Pen-R averaged 39.02 eggs per hen; Pen-P, 35.51; and Pen-O, 34.92. These averages will show us that the roosters did not influence the production of eggs. Pen-P, which was not provided with a rooster, yielded practically as many eggs as the others.

Table IV in which the "Number of Chickens," "Total possible Days," "Amount of Grain and Dry Mash Ration" consumed in kilograms by each pen per month are expressed, was prepared to show the average food consumption per hen.

By dividing the amount of grain and dry mash rations consumed by each pen per month by the average number of chickens, the average grain ration and the average dry mash ration, respectively, were obtained.

The table shows that in one year the average consumption of feeds was: grain, 20.384 kilos, mash 4.22 kilos; for Pen-O: grain, 18.519, mash, 3.321; and for Pen-R, grain 18.061, mash 3.140.

One reason for the difference in the results may be the ability of the individual birds in the pen to consume more food at one time than the average bird of the whole. One hen, in a pen, may

TABLE IV

AVERAGE FOOD COMSUMPTION PER HEN FOR THE MONTH

(Weights are given in kilograms)

Date	PEN-P					PEN-O					PEN-R				
	No. of Chickens	Total possible Days	Ave. No. of Chickens	Amt. of Grain Ration Consumed	Amt. of Dry Mash Ration Consumed	No. of Chickens	Total Possible Days	Ave. No. of Chickens	Amt. of Grain Ration Consumed	Amt. of Dry Mash Ration Consumed	No. of Chickens	Total possible Days	Ave. No. of Chickens	Amt. of Grain Ration Consumed	Amt. of Dry Mash Ration Consumed
1917															
Mar. 1-31.	10	310	10	14.340	5.106	11	341	11.000	14.774	4.518	12	372	12	15.236	6.275
April 1-30	10-9	288	9.60	13.020	2.408	11	330	11.000	12.896	2.622	12	360	12	16.254	1.901
May 1-31	9	279	9	20.004	4.999	11	341	11.000	14.746	5.221	12	372	12	19.254	5.535
June 1-30	9	270	9	12.028	3.012	11-10	314	10.460	16.428	2.605	12	360	12	18.050	1.621
July 1-31	9	279	9	17.220	2.195	10-9	303	9.770	13.145	2.690	12	372	12	17.235	2.480
Aug. 1-31	9	279	9	12.555	3.742	9	279	9.000	17.926	2.255	12	327	12	17.235	2.480
Sept. 1-30	9	270	9	20.600	2.942	9	270	9.000	15.642	2.020	12-11	363	11.70	21.913	2.035
Oct. 1-31	9	279	9	15.370	3.505	9	279	9.000	15.295	2.280	11-10	308	10.26	16.614	2.322
Nov. 1-30	9	270	9	17.414	2.024	9-8	264	8.800	14.156	1.522	10	310	10	15.340	2.445
Dec. 1-31	9	279	9	17.326	2.860	8-7	232	7.490	11.220	1.930	10-9	284	9.46	14.050	2.006
1918						7	217	7.000	12.348	2.351	9	279	9	12.455	2.205
Jan. 1-31	9	279	9	16.170	3.334	7	196	7.000	10.500	2.150	9	279	9	14.605	2.650
Feb. 1-28	9	252	9	15.400	2.530						9	252	9	12.400	2.750
Total Amount for the year				191.397	38.717				169.176	32.263				194.406	33.705
Total Ave. Amt. for the year consumed by one chicken															
				20.384	4.220				18.519	3.321				18.061	3.140

P-7 died on April 19, 1917.

0-7 died on June 15, 1917.
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R-3 died on August 23, 1917.
R-2 died on September 9, 1917.
R-9 died on November 15, 1917.

be a stronger feeder than another, yet the number of eggs she produced may be less than one which ate moderately.

In Pen-P the average consumption of dry-mash ration was about 1/5 that of the grain ration, while in Pen-O and Pen-R, it was about 1/6.

To the above feeds must be added about 35 grams of snails given to each pen every day from March 1 to November 22, 1917, or about 9,310 grams, and about 68 grams of ground bone given per day from February 1 to February 28, 1918, or a total of 1,904 grams.

TABLE V

CONSUMPTION OF FOOD PER HEN (IN KILOGRAMS) FROM MARCH 1, 1917, TO FEBRUARY 28, 1818.

Feeding Stuffs	Pen P	Pen O	Pen R
Corn	15.942	14.544	13.515
Rice	6.521	6.412	6.104
Rice bran	1.434	1.205	1.051
Copra	0.714	0.595	0.525

[1]Each egg was assumed to be worth P0.35

The hens in Pen-P consumed the largest quantity; in Pen O, the second largest; in Pen-R, the least.

Owing to the death of hens at different times, the number in each pen was not always the same. Consequently in the above table, the number of kilograms of snails and ground bone varies. During the nine months or thereabouts when snails were given, the average number of hens in Pen-P was 9.8, whereas in Pen-O and Pen-R the number was 9.6 and 10.6, respectively.

From February 1 to February 28, 1918, the period when ground bone was given, the average number of hens in Pen-P was 9; in Pen-O, 7, in Pen-R, 9.

In Table VI the grand totals show that feed including snails and ground bone was 25.772 kilograms per hen for one year, and the cost ₱1.952; in Pen-O, 23.993 kilograms and the cost ₱1.924; in Pen-R, 22.277 kilograms and the cost ₱1.66.

TABLE VI

COST OF FEED FOR EACH HEN FOR THE YEAR

Name of Feed	PEN-P Amount in kg.	PEN-P Cost per kg.	PEN-P Total cost	PEN-O Amount in kg	PEN-O Cost per kg.	PEN-O Total cost	PEN-R Amount in kg.	PEN-R Cost per kg.	PEN-R Total cost
		₱	₱		₱	₱		₱	₱
Corn	15.942	0.085	1.375	14.54	0.085	1.245	13.515	0.085	1.148
Rice	6.521	0.069	0.449	6.412	0.069	0.442	6.104	0.069	0.421
Rice bran	1.434	0.050	0.071	1.205	0.050	0.060	1.051	0.050	0.551
Copra meal	0.714	0.050	0.035	0.595	0.050	0.029	0.525	0.050	0.026
Snails	0.950	0.013	0.012	0.969	0.013	0.012	0.871	0.013	0.011
Ground bone	0.211	0.050	0.010	0.272	0.050	0.136	0.211	0.050	0.010
Grand total	125.772		1.952	23.993		1.924	22.277		1.661

TABLE VII

FINANCIAL STATEMENT PER HEN

Name of pen	Cost of food consumption per hen	Cost of egg production per hen[1]
P	₱1.952	₱1.242
O	1.924	1.222
R	1.667	1.365

The above table shows that in each pen on the average the cost of food consumed by each hen is greater than the cost of eggs produced by each hen during one year.

SUMMARY AND CONCLUSIONS

1. One hen in a pen may be a stronger feeder than another, yet the number of eggs she produces may be less than that produced by a hen which is a moderate feeder. This is shown in Table III and Table IV.

2. Molting occurred in the three pens during the period between the beginning of July and the latter part of December. In all probability hens did not molt at the same time.

3. In Pen-P only one hen died, whereas in Pen-O four died: in Pen-R three hens and two roosters died.

4. Table III shows that the highest egg production per month was during March, April, May and June, 1917, and February, 1918.

5. The average consumption of dry mash ration was between $^1/_5$ and $^1/_6$ that of the grain ration.

6. It was observed that hens were fatter when they were laying and became thinner toward the period of broodiness.

7. An average hen produced from 34.92 to 39.02 eggs and consumed from 18.061 and 3.14 to 20.338 kilograms of grain and 4.22 kilograms of dry mash rations, excluding the animal, mineral and succulent feeds during a year.

From the results obtained, it is safe to conclude that the presence of roosters in the pen does not influence the production of eggs, for Pen-P which was not provided with a rooster yielded practically as many eggs as the others.

Table VII shows that to keep the native hens for the purpose of egg production and to give them feeds as supplied in this experiment would be very unprofitable.

ACKNOWLEDGMENT

The writer expresses his hearty thanks to Associate Professor B. M. Gonzalez for his suggestions during the progress of the work and the preparation of this paper.

BIBLIOGRAPHY

Alder, Byron. Preserving Eggs for the Home. Circular No. **25**, Experiment Station, Utah Agricultural College. 1917.

Bell Arthur. Preserving Eggs, U. S. Dept. of Agr. Bull. No. *287*: 41-42. 1917.

Bowman A. E. Preserving Eggs Now for the Winter Use. The Wyoming Farm Bulletin **6**: 21-22. 1916.

Lamson G. H. Water Glass, a Preservative for Eggs. Agricultural Experiment Station (Storrs) Bull. No. **67**. 1911.

Langworthy, C. F. Eggs and Their Uses As Food. U. S. Dept. of Agr., Bull. No. **128**. 1906.

Thatcher, R. W. Preserving Eggs. Experiment Station, Pullman, Washington, Bull. No. **71**: 6-9. 1905.

True, A. C. Preserving Eggs in Water Glass. U. S. Dept. of Agriculture Bull. No. **296**: 29-30. 1907.

Vosseler, J. Eierkonservierung und Eierkonserven in den Tropen. Der Pflanzer **4**: 129. 1908.

Watson George C. Preserving Eggs. Farm Poultry: 325-326. 1912.

College and Alumni Notes

The following changes and promotions have been made in the personnel of the College of Agriculture:—Mr. Bienvenido M. Gonzalez, from assistant professor of animal husbandry at ₱3,600 per annum to associate professor at ₱4,000; Dr. Manuel L. Roxas, from assistant professor of chemistry at ₱3,600 to associate professor at ₱4,000; Mr. Inocencio Elayda, from assistant professor of agronomy at ₱3,600 to associate professor at ₱4,000; Miss Emma S. Yule, from instructor in English at ₱3,200 to assistant professor of the same subject at ₱3,600; Dr. Nemesio B. Mendiola, from instructor in agronomy at ₱2,000 to assistant professor at ₱3,000; Mrs. Charlotte R. Gillis, from instructor in English at ₱2,400 to assistant professor at ₱2,800; Mr. Elias Manalang, property and disbursing officer, and cashier, from ₱1,800 to ₱2,400; Mr. Alfredo V. Yñiguez, from clerk at ₱960 to chief clerk at ₱1,200; and Mr. Ceferino Patrimonio, stockroom clerk in the Department of Chemistry (new appointment), at ₱540. Mr. Joaquin Ruiz de Arana, formerly chief mechanician of this College and until recently connected with the Calauang Estate, has been taken again into the employ of the College of Agriculture, as farm engineer at an annual compensation of ₱2,000.

Mr. Alfredo P. Adriano, '14, is now connected with a new monthly known as *The Trans-Pacific*, which has its main office in the Japan Advertiser Building, Tokyo, Japan.

The following groups of students, accompanied by their teachers, visited the College of Agriculture during the month of February:

Class in Zoology 4 of the College of Education, University of the Philippines, February second; National Academy, February eighth; Senior Class of the Philippine Normal School, February fifteenth; Senior Class of the Rizal High School, February sixteenth.

The Philippine Society of Technical Agriculturists held its annual meeting at the Philippine Columbian Association building at Pasay Beach. The more important measures adopted concerned the proposed selection of a tract of agricultural land for exploitation by the society, and the election of officers for the next term.

Private advices received at this College announce the birth of a baby boy to Mr. and Mrs. Francisco D. Marquez. Mr. Marquez is a member of the Class of 1915 of this College and is at present in charge of corn-breeding work of the Bureau of Agriculture at the La Carlota Experiment Station.

Mr. Basilio R. Bautista, '18, formerly provincial agricultural inspector of the Bureau of Agriculture with station at Vigan, Ilocos Sur, has been transferred to Pasig, Rizal, where, he is now working as farm adviser in the food production campaign of the Department of Agriculture and Natural Resources.

Mr. Joseph A. Cocannouer, formerly assistant professor of agronomy at this College, is now employed as education manager by the Western Soil Bacteria Co., 442 Sansome Street, San Francisco, California, U. S. A.

Mr. G. A. Perkins, organic chemist of the Bureau of Science, has been working in the Chemistry Laboratory of the College of Agriculture on the investigation of papain, a substance obtained from the juice of papaya fruits, and for which there appears to be a demand among manufacturing chemists of the United States.

The Dean of the College of Agriculture has been advised by Acting President Escaler that from the scholarships allotted to the different colleges of the University four were assigned to the College of Agriculture.

Weather Observations for January, 1919.

Observer—R. P. Estioko.

Date	Rainfall in mm. Daily	Rainfall in mm. Weekly	Temperature in oC. Max.	Temperature in oC. Min.	Temperature in oC. Daily	Temperature in oC. Weekly	Wind in Miles Daily	Wind in Miles Weekly	Cloudiness	Atmometer Readings in cc. Evaporation Daily	Atmometer Readings in cc. Evaporation Weekly	Atmometer Readings in cc. Insolation Daily	Atmometer Readings in cc. Insolation Weekly
Jan.													
1	0		27.6	23.6	25.1		94.2		clear	14.1		8.5	
2	5.6		27.5	22.0	24.7		78.3		cloudy	17.8		8.6	
3	1.2		27.2	24.4	25.8		40.2		¾ cloudy	19.5		13.2	
4	4.2	11.0	26.5	22.6	24.5	24.9	58.0	424.0	cloudy	12.0	63.4	11.0	41.3
5	1.4		26.8	22.6	24.7		28.8		¾ cloudy	13.3		10.5	
6	3.6		25.5	21.6	23.5		60.0		cloudy	16.0		20.8	
7	.9		24.8	22.1	23.4		50.2		¾ cloudy	16.8		10.1	
8	.8		25.8	21.6	23.7		49.1		¾ cloudy	10.7		9.1	
9	0		26.5	21.6	24.5		91.7		¾ cloudy	17.6		6.9	
10	0		28.0	21.4	24.7		62.6		clear	21.9		25.6	
11	0	6.7	29.0	21.1	25.0	24.1	81.1	423.5	clear	23.0	119.3	26.1	119.1
12	0		27.5	20.6	24.0		122.4		clear	25.8		25.9	
13	0		28.5	20.6	24.5		29.1		clear	23.0		26.7	
14	3.5		26.8	20.8	23.8		41.7		¾ cloudy	14.3		17.4	
15	0		27.8	21.1	24.4		37.3		¾ cloudy	28.4		16.7	
16	3.4		26.8	22.1	24.7		53.6		¾ cloudy	19.7		23.9	
17	0		27.8	20.8	24.3		36.4		clear	25.2		38.9	
18	0	6.9	28.0	20.6	24.3	24.3	55.6	376.1	clear	39.3	175.7	28.3	177.8
19	.6		27.0	20.8	23.9		18.3		¾ cloudy	24.3		16.2	
20	8.9		26.0	21.1	23.5		27.1		¾ cloudy	18.5		17.5	
21	0		27.2	21.6	24.4		58.7		clear	39.3		27.9	
22	0		27.0	20.4	23.7		39.5		clear	37.7		23.7	
23	0		27.0	20.6	23.8		82.5		clear	42.4		28.0	
24	0		27.2	19.6	23.4		47.1		¾ cloudy	51.8		17.5	
25	0	9.5	28.0	20.0	24.0	23.8	70.0	343.2	clear	36.8	250.8	27.2	158.0
26	0		28.0	21.1	24.5		37.6		¾ cloudy	36.4		26.0	
27	0		27.2	19.8	23.5		78.5		clear	45.4		22.4	
28	4.2		27.0	21.1	24.0		42.3		½ cloudy	25.8		11.4	
29	0		28.5	22.1	25.3		71.9		¾ cloudy	34.1		12.3	
30	0		27.5	19.8	23.6		36.0		¾ cloudy	36.1		26.2	
31	0		29.0	19.6	24.3		35.0		¾ cloudy	31.4		20.7	
Month		38.3				24.2		1714.8			818.4		615.2
Feb. 1	0	4.2	29.0	21.1	25.0	24.3	27.3	328.6	½ cloudy	26.6	235.8	20.7	139.7

Coffee Plantation.

Date:	Rainfall Weekly	Max.	Min.	Mean Weekly
Dec. 30-Jan. 5	11.5	28.5	17.0	22.7
Jan. 6-Jan. 12	17.5	28.4	18.4	23.4
Jan. 13-Jan. 19	11.3	28.8	19.2	24.0
Jan. 20-Jan. 26	6.7	28.8	17.0	22.9
Jan. 27-Feb. 2	4.5	29.0	18.0	23.5

Summit of Maquiling.

Dec. 30-Jan. 5	21.5	18.8	17.7	18.2
Jan. 6-Jan. 12	11.5	19.1	16.4	17.7
Jan. 13-Jan. 19	11.1	18.3	16.3	17.3
Jan. 20-Jan. 26	8.3	17.8	15.7	16.7
Jan. 27-Feb. 2	3.8	18.6	16.4	17.5

450 m. Elevation Mt. Maquiling.

Dec. 30-Jan. 5	28.4
Jan. 6-Jan. 12	14.8
Jan. 13-Jan. 19	11.4
Jan. 20-Jan. 26	9.2
Jan. 27-Feb. 2	5.3

January was distinctly dryer than average, insolation was high, temperature and wind velocities about normal. Unirrigated garden crops suffered severely, but corn was not injured.

F. T. McLean,
Associate Professor of Plant Physiology.

UNIVERSITY OF THE PHILIPPINES

COLLEGE OF AGRICULTURE

LOS BAÑOS

The College of Agriculture is in its ninth year with a student body of nearly 360. It occupies a tract of about one hundred and twenty-seven hectares on which every important crop in the Philippines is under cultivation. It has a large series of varieties of leading crops and very numerous introduced plants under tests and observation. The number of distinct cultures, not including series of fertilizer experiments, is more than two thousand. The College has twelve concrete buildings and two of mixed materials.

The courses are:

A six-year course (the first two years' work being preparatory only) based on graduation with good grades from the intermediate schools of the Philippine Islands and leading to the degree of Bachelor of Agriculture.

A four-year course based on the completion of the public high school course, and leading to the degree of Bachelor of Science in Agriculture.

Graduate work leading to the degree of Master of Science is given to persons holding the degree of Bachelor of Science.

Tuition for non-residents of the Philippines is ₱150.00 a year.

The College year will begin June 9, 1919.

For further information address the Dean of the College.